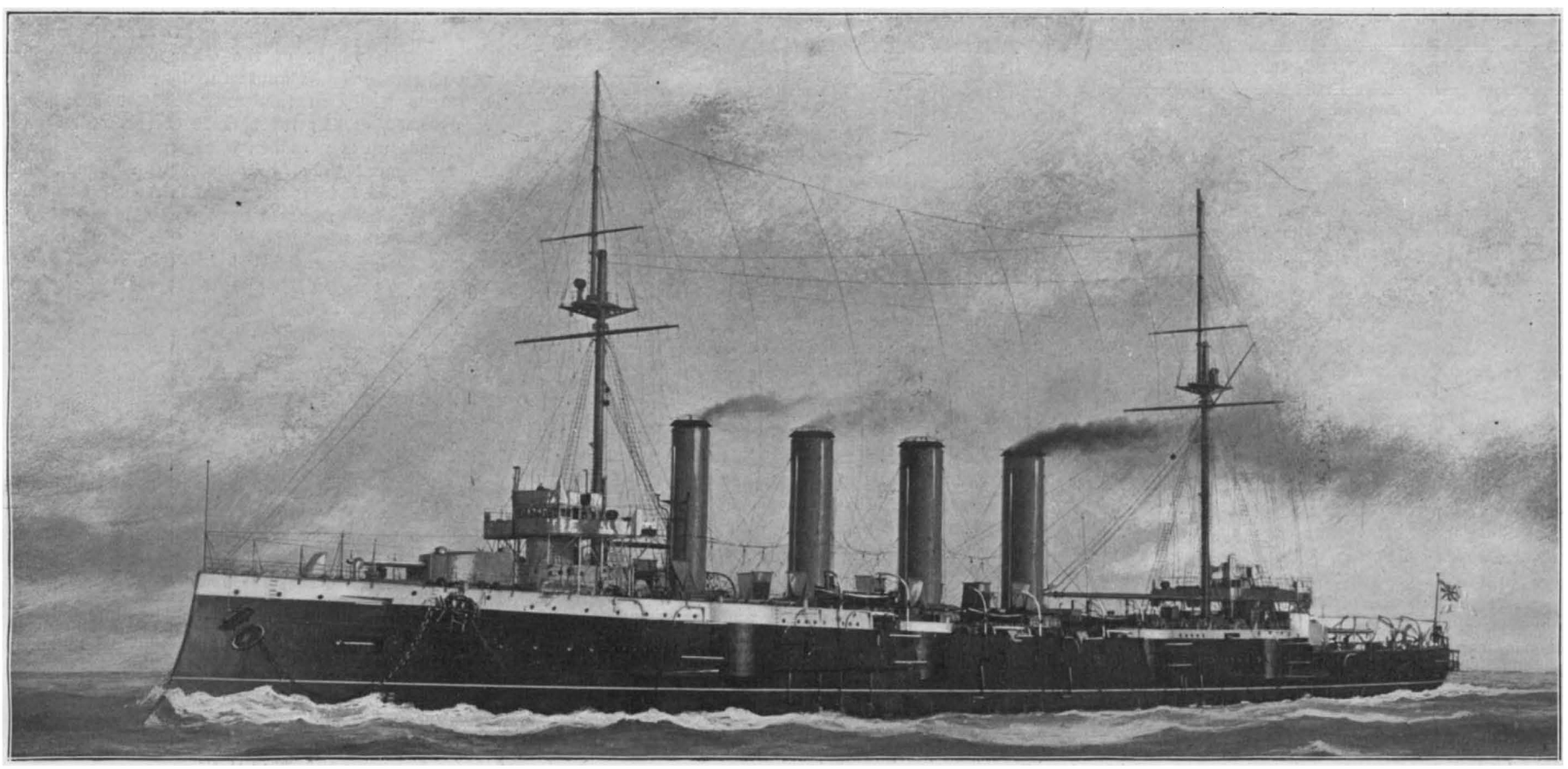
SCIENTIFIC AMERICAN

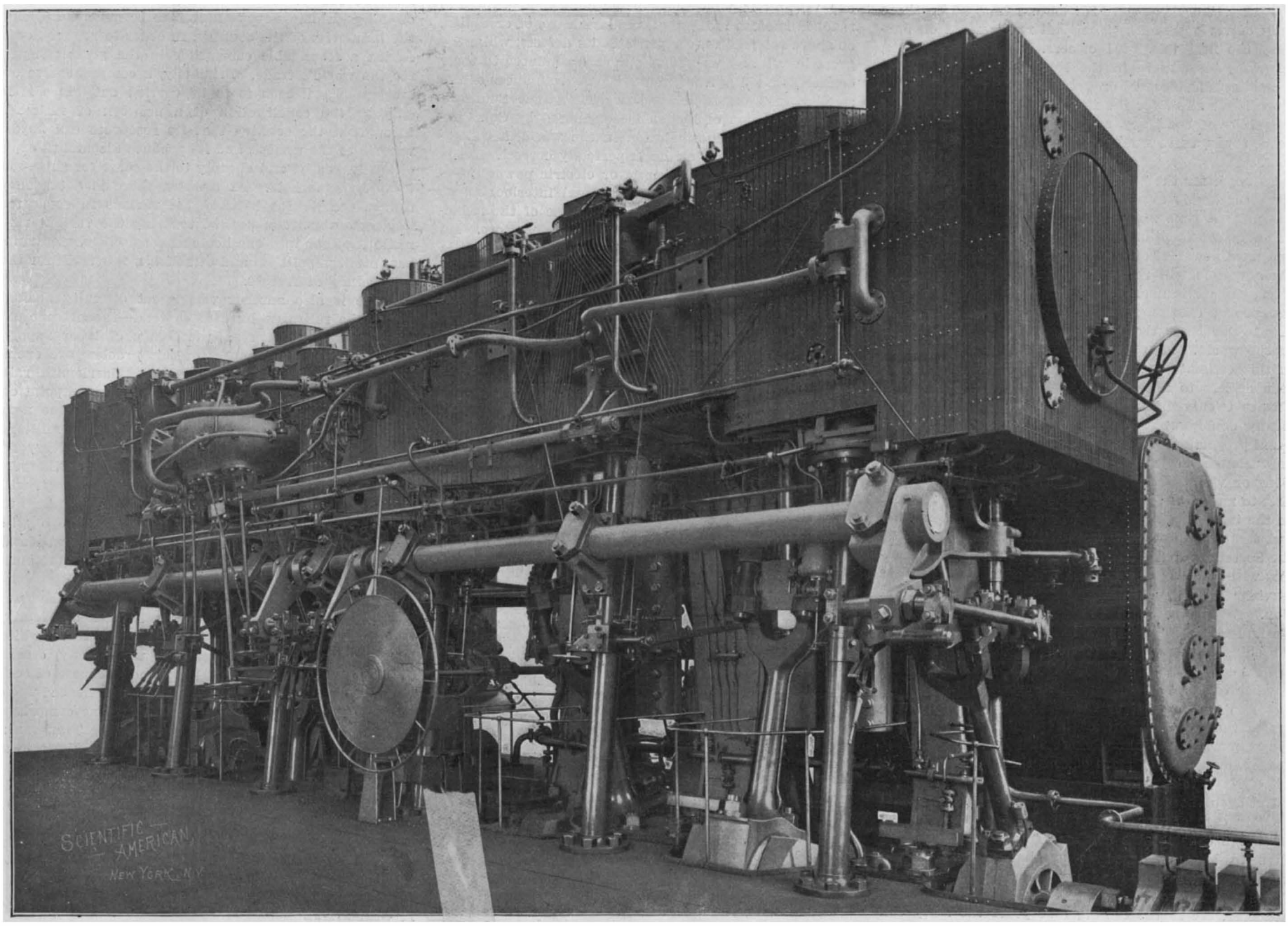
[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright, 1902, by Munn & Co.]

Vol. LXXXVII.—No. 16. ESTABLISHED 1845. NEW YORK, OCTOBER 18, 1902. $3.00 A YEAR. 8 CENTS A COPY



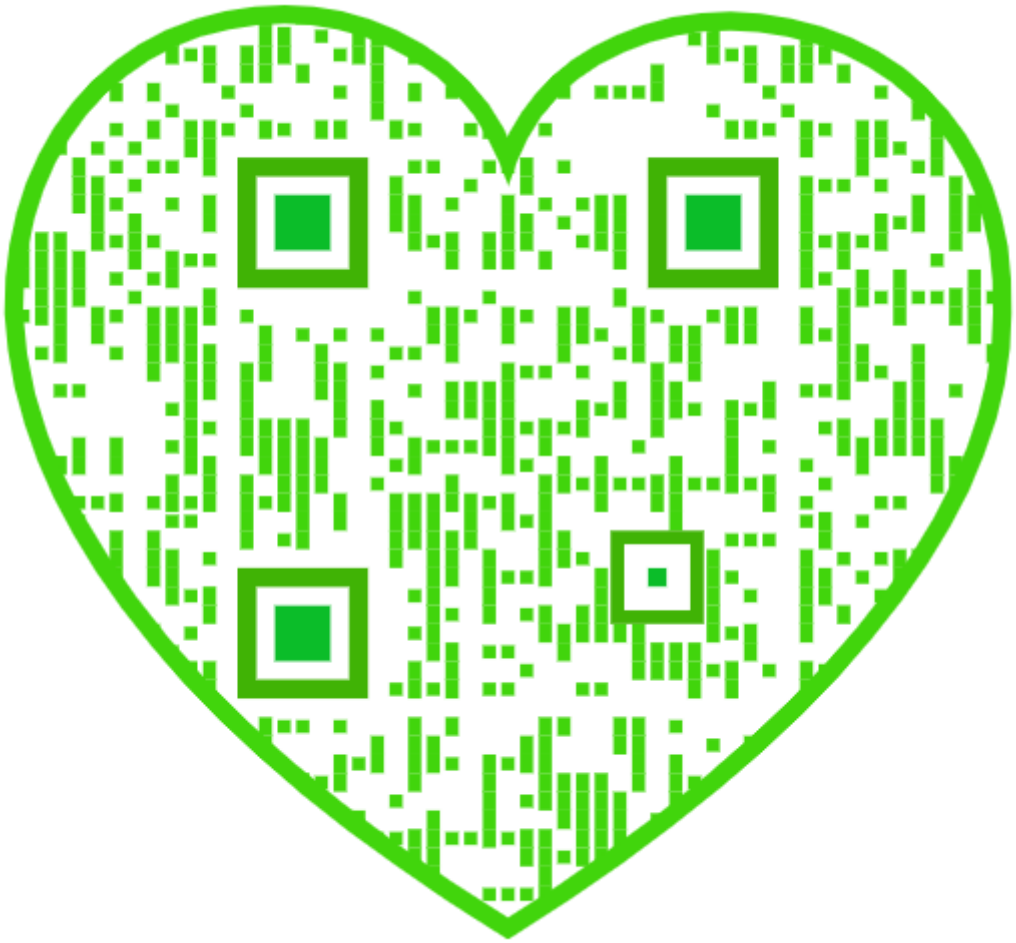
NEW BRITISH ARMORED CRUISER "GOOD HOPE."

Displacement, 14,100 tons. **Speed,** 23.05 knots. **Maximum Coal Supply,** 2,500 tons. **Armor,** belt, 6 inches, gun positions, 6 inches. **Armament,** two 9.2-inch; sixteen 6-inch rapid-fire; twelve 3-inch rapid-fire. **Torpedo Tubes,** 2. **Complement,** 900.



ENGINES OF THE "GO PE." INDICATED HORSE POWER ON TRIAL, 31,071.—[See page 257.]

© 1902 SCIENTIFIC AMERICAN, INC.



SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO., - - Editors and Proprietors

Published Weekly at

No. 361 Broadway, New York

TERMS TO SUBSCRIBERS

One copy, one year for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845) ..... $3.00 a year
Scientific American Supplement (Established 1876) ..... 5.00 "
Scientific American Building Monthly (Established 1885) ..... 2.50 "
Scientific American Export Edition (Established 1878) ..... 3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, OCTOBER 18, 1902.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE PRESSING NEED OF OUR NAVY.

There is need for a very thorough agitation of the question of the increase in the number of our naval officers; for it is certain that neither the people at large nor their representatives in Congress appreciate the very grave crisis which has been precipitated by the failure to make adequate provision for manning the new ships of the Navy. It is easy to understand, if not to excuse, the ignorance or indifference which exists with regard to this question, which is due doubtless to the fact that we are more affected by what we can see with our own eyes in the shape of big battleships, powerful cruisers, etc., than we are by statistical figures indicating the present and future strength of the personnel for manning these ships. For several years past it has been perfectly well understood in official circles that we were building new vessels very much faster than we were providing men and officers to man them; but up to the present time Congress has shown a strange apathy in dealing with the situation. The matter, however, has come to such a pass that this question will be one of the most, if not the most, important that will confront the next Congress, and as the following figures, given by the Secretary of the Navy, prove, the matter will not admit of the least delay.

At the beginning of the present year there was a demand for the proper manning of the serviceable ships of our Navy of 1,237 officers of the line, and at the same time there were 264 officers engaged on shore duty of various kinds. The total requirement on January the first was 1,631 officers. On the same date, however, there were in the Navy only 1,023 officers, including midshipmen, or 608 less than were required. Even if we allow for the fact that about one-fourth of the ships of the Navy are out of commission during peace times, there would still be a shortage of 300 officers.

So much for the present. With regard to the future the situation is even more alarming, for we have at the present time sixty or seventy vessels authorized, or under construction, of which several are the largest and most powerful of their kind in the world. To man these vessels will require 498 additional officers, and this estimate is made on the basis of a minimum allowance of officers per ship, the allowance being far less in our Navy than in any of the first-class navies of the world. This is proved by the fact that, while in this estimate the United States allows only seventeen officers to a battleship, Germany allows twenty, France twenty-six and England thirty-three, or practically double what we do. If we estimate that the usual proportion of officers will be on shore leave, sick, on furlough, or in transit from foreign to home stations or vice versa, we must have 623 officers on the lists to man these ships with the 498 that they require. In the intervening four years between the present date and the completion of these vessels, it is estimated by the Secretary of the Navy that no less than 160 vacancies will be created by the death of officers, or by their leaving the service through disability, or by resignation. Adding these to the total already arrived at, we find that 783 officers will have to be provided for the ships now in course of construction, all of which are expected to be in commission by 1906. Add this number to the 608 officers which we are short of today, and we find that by the date named, if we are to properly officer our fleet, even on the limited number per ship which we allow, there will be required 1,391 officers, or a total of more officers than we have in the whole Navy to-day.

But even these figures would not represent our total need in case of war, for, as in the Spanish-American conflict, a considerable number of naval officers would have to be transferred to auxiliary vessels which would be taken up by the Navy to meet the emergency. These officers could not be drawn from the Naval Academy, for in the coming four years the Navy can only reckon upon receiving 355 graduates from the Academy and this would still leave us more than a thousand officers short of the proper complement. It is true that the law allows promotion from the ranks; but at present the number must not exceed six per annum, and while it might be increased to advantage, it must be remembered that the duties of a modern naval officer require a man of an exceedingly broad range of knowledge, such as can only be gained by a thorough course of study for a period of years at the Annapolis Academy.

In view of the facts given above, it is evident that no measure connected with the defenses of the empire can be brought before the next Congress that will have anything like the urgency of the naval personnel bill.

BRITISH CRITICISM OF AMERICAN RAILROADS.

Discussion of American institutions by fair-minded and competent critics is always valuable and welcome. From time to time we receive visits of inspection from accredited experts of other countries, who are given every facility to examine our social and industrial institutions. In 1901 Col. W. B. Constable, the Manager of the Eastern Bengal State Railway in India, was sent over to examine the working of our railroads, and his report, which is characterized by well considered criticism, shows that he was well qualified for the task. His tour of inspection included a great many of our leading railroads and an investigation of their shops, rolling stock, track, stations and systems of signaling. With regard to the track, he thinks that our method of laying rails with broken joints, that is to say, with the joint of one rail immediately opposite the center of the other rail, is peculiar to this country; and while we differ from the rest of the world in this respect, he presumes that we have the best of reasons for the practice. He commends our use of from 2,500 to 3,050 cross-ties per mile of track, as compared with the 1,760 to 2,000 ties per mile used in India and England, since it cannot be questioned that the greater number of ties gives a smoother and stronger track. He also commends our shorter and narrower platforms as being cheaper than those used in India, and he would imitate us in permitting level crossings at small stations, claiming that the Indian practice of requiring overhead bridges at the small stations is too costly. On this last point we must admit that we can scarcely agree with his findings; for the large number of people killed annually at railroad crossings in this country suggests surely that more overhead bridges and fewer grade crossings, as in India, would be to the public advantage. He considers with much reason that our fencing is wretchedly poor; and that while the roadbed is often indifferent, the lavish use of cross-ties, as above referred to, compensates its defects, while the great length and weight of our cars conduces to their comfortable riding compared with the roughness of the smaller cars on Indian roads. The great Southern Terminal station of Boston is considered by Col. Constable to be the finest station in the world, a conclusion in which we think he is perfectly correct. He is of the opinion that pneumatic or electric power interlocking will take the place of manual interlocking at large stations, more particularly because of the reduction in plant and the necessary staff of operators. He was very favorably impressed by the use of automatic block signals in this country, and he has no doubt that English roads will ultimately adopt some form of automatic system, which will also be found indispensable in such large cities as Calcutta, Bengal and Madras.

To the New York Central Road he gives credit for having the best railroad joints that he found anywhere in the United States, and the criticism is well made. The New York Central have always used three-tie joints, that is joints with a tie near the end of each rail, and an additional tie immediately below the joint. This ample bearing, combined with the use of long six-bolt angle bars, has given a joint which, when it is kept in good condition, is so smooth as to be inaudible to passengers riding on the cars. It is curious to note that the critic was struck, as many everyday passengers have been, with the difference between the joints on the New York Central and on the New Haven lines. On the latter road short four-bolt angle-bars are used with a single tie at each rail end, and none immediately beneath the joint. As a consequence the joints are generally low, a point which did not escape the eye of this critic. He was favorably impressed with the American rails, which he characterizes as being heavy, tough, stiff, of great tensile strength, and with a broad head. He himself has always been an advocate of the heavy rail section, and he considers that he found a strong indorsement of his views in the good results obtained from their use in this country.

WHERE OUR MANUFACTURES GO.

Those of us who are watching the present wo derful commercial expansion of their country will be interested to learn what countries our manufactures are sent to and in what proportions. During the year 1901, 62 per cent of our exported manufactures were carried to Europe, and 23 per cent to North America, these two countries together taking three-quarters of our exports. Of the balance, 8.2 per cent went to Asia; 7 per cent to Australia, New Zealand, etc.; 6 per cent to South America, and something less than 3 per cent to Africa. The total value of the exports to Europe was $215,000,000, and to North America, outside of the United States, $96,000,000, the exports to other countries being in the proportions as given above. An analysis of the nature of these exports shows that the largest item of European exports was $44,000,000 worth of iron and steel manufactures. It will be a matter of surprise to learn that almost an equal amount of copper manufactures was exported, the total value being about $41,500,000, while the exports of refined or manufactured oil were not far behind, the total being $40,736,000. The values of the other principal exports were, of leather and manufactured leather goods, $21,000,000; agricultural implements, $10,500,000; drugs and dyes, $6,741,000; the balance of the total exports being made up of paraffine, wood manufactures, scientific instruments, etc., in decreasing amounts. The largest item in the exports to North America was iron and steel, which were sent out to the value of $43,518,000; the next items in point of importance being cotton manufactures, $6,628,000; and cars and carriages, $3,577,000. To South America, the largest exports were of iron and steel to the value of $8,750,000; to Asia of refined or manufactured oils to the value of $12,442,000; while to Oceania the principal manufactures exported were iron and steel valued at $8,872,000. Historically, it is interesting to note that in 1790 the total exports of manufactures from this country amounted to only a little over $1,000,000 and formed only 6 per cent of the total exports; in the decade 1791-1800 exports of manufactures averaged only about $2,000,000 per annum, and they never reached as much as $10,000,000 per annum prior to the year 1840. In the year 1850 exports of manufactures had reached a total of $17,500,000; in 1860 they reached the $40,000,000 mark, and in 1870 the total stood at $68,280,000. It was not until 1877 that they passed the $100,000,000 line, the total for the year being $122,577,000. Nineteen years later, in 1896, the total value passed the $200,000,000 mark and had risen to $223,571,000. In 1899 the total was $339,600,000 and during the present century the exportation of manufactures has constantly exceeded $400,000,000 per annum.

RAILROAD EXPANSION IN SOUTH AFRICA.

Following the declaration of peace in South Africa, and the return of the country to the normal order of things, a determined effort is to be made to develop the industries of the country, in order to render South Africa a formidable competitor in the great struggle for the world's trade. Primarily, a comprehensive extension of railroads is to be carried out, since it is only by the construction of a network of railroads throughout the country that its resources can be developed to the utmost, and its produce dispatched expeditiously, easily, and cheaply to the coast for shipment to foreign markets. At present, there is a tendency toward competition between the various railroads for the traffic, but it is desired to bring the various railroads together into one homogeneous whole, stop ruinous inter-competition, and establish a fair tariff for the conveyance of freight.

There is also another very great difficulty against which the railroads have to contend—the present unsatisfactory condition and deficiency of labor supply. The far-reaching influences of this problem are exemplified in connection with the Natal-Harrismith railroad either via Reitz or Wilge River, to some point on the Central South African Railroad's main line near Vereeniging. This railroad was extended for military purposes during the war for eighteen miles beyond Harrismith to Elands River, and surveys for the rest of the route are to be carried out. These surveys will be completed in about six months. The advantage to Natal of this connection will be very great. It will save about one hundred miles of uphill haulage, and will shorten the route from Durban to Johannesburg by over forty miles. It will also shorten the distance by rail from Durban to Cape Town considerably. But unless a solution is found to the native labor difficulty, or some means are adopted to provide skilled white labor, this railroad, in common with many others equally important, will be a long time in course of construction, even if work is immediately commenced upon it. The present railroad extensions scheme comprises the surveys for the following lines in the Transvaal:

1. A track from Springs over the High Veldt to a junction with the main railroad near Machadodorp.
2. The remaining unsurveyed portion of the railroad from Vereeniging to Johannesburg (direct route).
3. A track from Krugersdorp to Rustenburg.

In the Orange River Colony the projected railroads are:

1. A track from the present terminus at Elands River, near Harrismith via Reitz, or the Wilge River, to Vereeniging.

© 1902 SCIENTIFIC AMERICAN, INC.

2. A road from the present terminus of surveys on the Bloemfontein-Ladybrand Railroad (Thaba Nchu), through Modderpoort to Ficksburg.

3. A track from Fauresmith to Koffyfontein.

The former surveys of the roads Harrismith-Bethlehem-Heilbron, Belfast-Lydenburg, and Pretoria to Rustenburg are already in hand. The survey from Fauresmith to Koffyfontein is an extension of the existing railroad from Springfontein to Fauresmith on which the track has not yet been laid.

The branch from Machadodorp to Ermelo, which was under construction by a company before the war, is to be completed by the company at its convenience. The earthworks were well advanced when work had to be stopped.

There are numerous other extensions well in hand, but in several instances, where the roads were commenced before the war broke out, and conflict with the latest arrangements or existing roads, they are in a state of chaos. This is notably the case with the Silati Railroad. The extension from Pietersburg toward Rhodesia via Tuli, is liable to be objected to by both the Cape and Rhodesian Railroads, and unless union of the schemes is effected such an extension would probably divert much traffic from the two last named. It is not considered advisable to construct any such roads through districts already adequately supplied with railroad facilities. The government is going to relay the whole of the main railroad through the Orange River Colony with 80-pound metal rails to allow the use of heavier and more powerful locomotives, and thus increase the train loads. A comprehensive system of light railroads connecting the main road to outlying districts is to be carried out to facilitate transport. A branch from Bloemfontein to Thaba Nchu will probably be completed in about six weeks, and it is the intention eventually to continue it to Ficksburg.

The new direct line from Vereeniging to Langlaagte or the West Rand, upon which the heaviest types of locomotives are to be used to enable heavy loads to be drawn, will probably be one of the first to be completed as soon as labor is available. All the embankments, etc., were constructed during the war, except about ten miles near the center, in a district then occupied by the enemy. The survey of these ten miles is to be proceeded with at once. In connection with this direct railroad the "coal road" along the reef will be completed, and also the sidings into the mines, involving the laying of some forty-five miles of track, chiefly in the sidings.

THE THREE HUNDREDTH ANNIVERSARY OF OXFORD'S BODLEIAN LIBRARY.

On October 8 and 9 the University of Oxford celebrated the three hundredth anniversary of its famous Bodleian. When it was first opened, November 8, 1602, in the building erected in 1487-8 over the Divinity School, by Humphrey, Duke of Gloucester, the library contained only 2,000 books. The Bodleian had its comparatively humble origin in the bequest by Bishop Cobham, of Worcester, of some books, for which was built in the later years of the fourteenth century a little room in an annex to St. Mary's Church. About a hundred years later, Humphrey, of Gloucester, who seems to have been a kind of Mæcenas, gave books and manuscripts to the university, which were only too zealously destroyed by the fanatical anti-Popery commissioners of Edward VI.

Sir Thomas Bodley, after whom the library was named, was born in Exeter in 1545. His father, John Bodley, on Mary's accession, fled to Geneva, where his son attended lectures on Hebrew and Greek, as well as those of Beza and Calvin on divinity. After the death of Mary the family returned to England and Thomas entered Magdalen College, Oxford, in 1563. He was elected Fellow of Merton. Entering the diplomatic service, Bodley became Elizabeth's Minister to the Hague. Disappointed by Burghley he retired into private life, resolving, as he tells us, to set up his staff at the library door in Oxford, and to restore that place, then in a pitiful state of ruin, to the public use of students. In order to accomplish this purpose he began the establishment of a library in 1598, using as a nucleus the few books of Duke Humphrey and Roger Lisle which had escaped the ravages of Edward VI.'s commissioners. In four years Bodley collected and catalogued about 2,000 volumes. Walter Raleigh and other friends aided him. Bodley induced the Stationers' Company, in 1610, to send to Oxford a copy of every work which they printed. Out of his own pocket he paid for a third story to the "Schools;" but he never lived to see the fulfillment of his labors. In his will he provided for the endowment and maintenance of the library.

In 1639 the Abbot of Osney, Thomas Huskenorton, reduced the public schools into one building. Archbishop Laud, John Selden, the Earl of Pembroke and Sir Kenelm Digby ranked among the earlier benefactors of the library. To the contents of the Bodleian have been added, during the last three centuries, the statues given in 1755 by the Countess Dowager of Pomfret, antique marbles presented by Selden's executors, and the inscribed marbles gathered by Thomas, Earl of Arundel, at his house in the Strand, London, which his grandson, Thomas, Duke of Norfolk, persuaded by Evelyn, gave in 1667 to the University. Of interest are also the Gough (topography and MSS., 1799), Ballard, Wood, Rawlinson, Malone, Douce and Sutherland collections. The auctarium on the chief stairway is reserved for the choicest books and illuminated MSS. Many rare portraits are to be found in the old library. The picture gallery contains Fouquet's models of ancient buildings; Allan Ramsay's portrait of Flora Macdonald, painted in 1749; portraits of Mary Queen of Scots, and Sir Kenelm Digby; some splendid busts, and the brass statue executed by Hubert Le Sœur from designs by Rubens of William, Earl of Pembroke. In an apartment known as the "Old School," may be found the Hope collection of 200,000 books and engraved portraits. So largely has the number of volumes increased that the printed books alone amount to nearly 600,000 in number, while the manuscripts number about 28,000, and so overwhelming has been the overflow that the contents of the adjacent Radcliffe were transferred forty years ago to the University museum in order to make room. The modern books have been removed into the Radcliffe, which is now called the "Camera Bodleiana."

AN EXAMPLE OF WIRELESS TELEGRAPHY'S EFFICIENCY.

A very adequate idea of the utility of the Marconi wireless telegraphic invention, and the wide and beneficial influence it will exercise from a commercial point of view, in connection with vessels engaged in the transatlantic traffic, was afforded recently by the log of the Cunard liner "Campania" on a round voyage from Liverpool to New York and back. The "Campania" left Liverpool at 4:30 P. M. on Saturday, August 30, and remained in communication until 6:10 P. M. with the same company's steamer "Ivernia," also fitted with the Marconi system, which was lying in the Huskisson Dock, Liverpool. From 7:05 to 8 P. M. she was in communication with the homeward-bound "Umbria" in the Mersey Channel. At 8:30 Holyhead was signaled, followed by Rosslere station at the southeast corner of Ireland until 3 A. M. on Sunday, August 31. Passengers and mails were embarked at Queenstown, and the ship sailed at 10:15 A. M. on Sunday, August 31. She was then in communication with Crookhaven from 11:40 A. M. until 3:15 P. M. At 1:35 A. M. on September 3 she came into communication with the homeward-bound "Lucania" and exchanged messages with her for some time. At 4:45 P. M. on September 5 she signaled Nantucket lightship, and continued in communication until 8:30 P. M. At 11:30 P. M. Sagaponack station replied to her call, and continued talking until 1:40 A. M. the next day, when she was abreast of Fire Island, distant about 60 miles, and the new station at Babylon, north of Fire Island, came into communication about the same time as Sagaponack ceased. She kept in touch with the latter until Sandy Hook lightship was passed at 3:18 A. M.

On the homeward passage the "Campania" left New York on September 13 and was in communication with the "Umbria," which was just arriving at that port between quarantine and dock. She then got in touch with the Babylon station at 7:40 P. M., and continued until 1:40 P. M. Then Sagaponack station followed. She next communicated with the inward-bound "Lucania" on September 16 at 11 P. M. and continued until 1:40 A. M. on the following day. On the 17th she conversed with the Atlantic Transport vessel "Minnehaha" for some hours. The Cunard homeward-bound "Saxonia" was signaled at 2:50 P. M. on the 18th, when she was 36 miles ahead of the "Campania," and the two steamers were in communication until the evening, when the "Saxonia" was 100 miles astern. Crookhaven was signaled on the 19th at 8:45 A. M. and conversation was maintained until 11:40 A. M. The "Campania" arrived at Queenstown at 12:50 A. M. on the same day.

From this log it will be seen that it is practically possible to cross the Atlantic, and to remain in communication with the land all the way across via various ships, which can act as retransmitting stations. If all the vessels plying between this country and Europe were similarly equipped with the Marconi apparatus, it would be possible for a man to remain *au courant* with home or the commercial world the whole of the five or six days' sea passage.

SUCCESSFUL TEST OF A TOWER ELEVATOR.

An experimental four-hundred foot drop of the Philadelphia City Hall tower elevator recently proved that the safety air cushion device installed will probably prevent any serious accident. Within the short distance of 84 feet the speed of the car was reduced from 2½ miles a minute to zero. In the car were placed eggs, delicate incandescent light bulbs and rats. When the car reached the bottom most of the eggs were found in good condition, the incandescent light bulbs were intact and the rats alive and well. The trip was made directly under the Penn statue, 372 feet 9 inches above the bottom of the shaft. The particular safety device used is the Ellithorpe safety air cushion.

SCIENCE NOTES.

In order to encourage the study of science among women, the Association for Promoting Scientific Research Among Women has offered two prizes of $1000 each for the best papers prepared by women. One is for the best work based on independent laboratory research in biological, chemical or physical science, and the other on any scientific study. The chairman of the prize committee is Miss Ellen H. Richards, of the Massachusetts Institute of Technology, Boston.

The United States Coast and Geodetic Survey has published a very handsome and serviceable map showing the lines of equal magnetic declination and of equal annual change in the United States for 1902. The lines of equal magnetic declination or isogonic lines are given for every degree and are based on a new observation up to July 1, 1902. The lines of equal annual change of the magnetic declination pass through all the lines where the annual change is of the same amount.

A woful cry is going up from the representatives of all the ologies, and one hears nothing but a doleful wail about shrinking incomes and curtailing of operations. Take the Palestine exploration fund, for example. Here the secretary laments a decrease of the society's income by nearly one-third within the past three or four years, and he attributes this in a great part to the war, the absence of so many of the most influential and wealthy officers and the corresponding anxiety of their families.

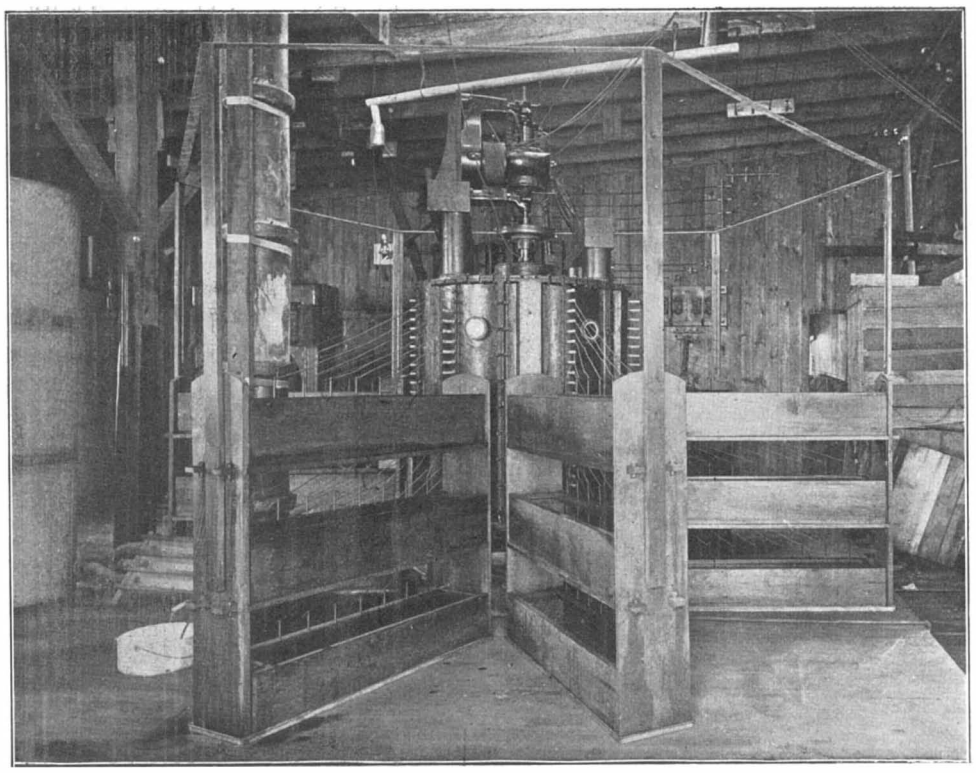
It is generally believed that the bite of sea serpents, or hydrophids, is not dangerous, but this is not so, and cases of death from this cause have been observed by Comtor in Japan, Fayrer in India, and Forné in New Caledonia. M. Kermorgant has published some new observations in the Annales d'Hygiene et de Medecine Coloniales. The geographical distribution of the sea serpents is very extensive, embracing a marine zone which is bounded on one side by the coasts of Asia and Africa and on the other by the west coast of Central America; Australia is included in this region. The species are numerous and they are all dangerous. These include the *Hydrophis nigra* and *H. nigrocyneta*, of the Indian Ocean and the seas of China; the *H. chloris*, of the Indian Ocean, also the *H. cyanocyneta*, as well as the *Pelamys bicolor* of the Australian coast. If the effects of their bite have not been more often pointed out it is because they are not mortal in a great number of cases. In many of the colonies of New Caledonia these serpents are found in abundance, and the opinion is so general that they are harmless that the snake charmers use them in their performances. In fact, they bite but rarely and with difficulty owing to the smallness of their mouth, and the dangerous effects are not frequent as they have only very small venom-glands and minute fangs. The head, which is small, is scarcely to be distinguished from the body, while the tail is flattened in the form of an oar. The length often exceeds three feet. A rat, when bitten by one of these serpents, dies in four or five minutes.

H. Rieder reports a continuation of the experiments begun by him in 1898 relative to bactericidal power of Röntgen rays. The bactericidal power of the Röntgen rays was tested against the cholera spirillum, the bacillus prodigiosus and the colon bacillus. The micro-organisms were inoculated into gelatine or agar and exposed to the action of the rays in Petri dishes, the covers being removed. After twenty to thirty minutes' continuous exposure to the rays many of the bacteria were killed, and multiplication ceased in nearly all. In every series of experiments, however, a few of the individual bacteria were not affected. Experiments have shown that the bactericidal power of the rays is not due to the fluorescent light, heat, ozone or electricity. So far as is known the culture media are not altered by the rays or made unsuitable for the growth of bacteria. Gelatine is never liquefied. It is not, however, to be assumed on the basis of the above experiments that the Röntgen rays possess any bactericidal action upon bacteria when present in the animal body. The evidence from animal experimentation is against such a supposition. As a rule, animals inoculated with pathogenic bacteria and exposed to the rays die sooner than similarly inoculated animals which are not thus exposed. It is not to be denied that in the human subject certain infectious diseases, particularly those of the skin, may be successfully treated by the Röntgen rays, but it does not seem probable, at the present time that such success is due to bactericidal action.

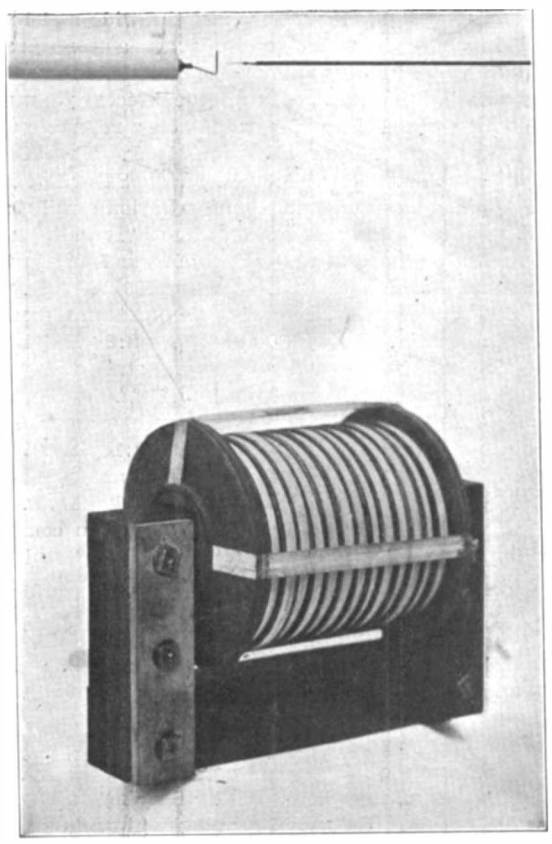
© 1902 SCIENTIFIC AMERICAN, INC.

THE COMMERCIAL UTILIZATION OF ATMOSPHERIC ELEMENTS.

In order to properly introduce this subject to our readers we must turn back to the fall of 1898, when the attention of the world was directed to a serious problem. Sir William Crookes in his inaugural address before the British Association discussed the probable future shortage of wheat as a result of the failing supply of nitrogenous fertilizers. He pointed out that guano beds which had for a long time formed the principal supply of nitrogenous manures were almost exhausted, and practically the only compound of nitrogen then available for use as fertilizer was found in the nitrate of soda deposits which cover a limited area in the north of Chile. As a possible solution of this grave question, Sir William Crookes suggested the fixation of atmospheric nitrogen by means of electricity, and predicted that for such an enterprise Niagara would prove the best location, because of the low cost of electricity at that place. A short time after this two American inventors, Mr. Charles S. Bradley and Mr. D. R. Lovejoy quietly began a series of experiments. Seemingly the only thing necessary was to produce a series of powerful disruptive discharges which would burn the air and produce the required gases, but the problem did not prove to be so simple. Difficulties were met from the beginning. A complete history of the efforts and failures of these two inventors would be a long story, but suffice it to say that disruptive discharges were found to give very poor results, and it was only when electric arcs were tried that the subject gave promise of success.



APPARATUS FOR OBTAINING NITROGENOUS COMPOUNDS BY BURNING AIR WITH ELECTRIC ARCS.

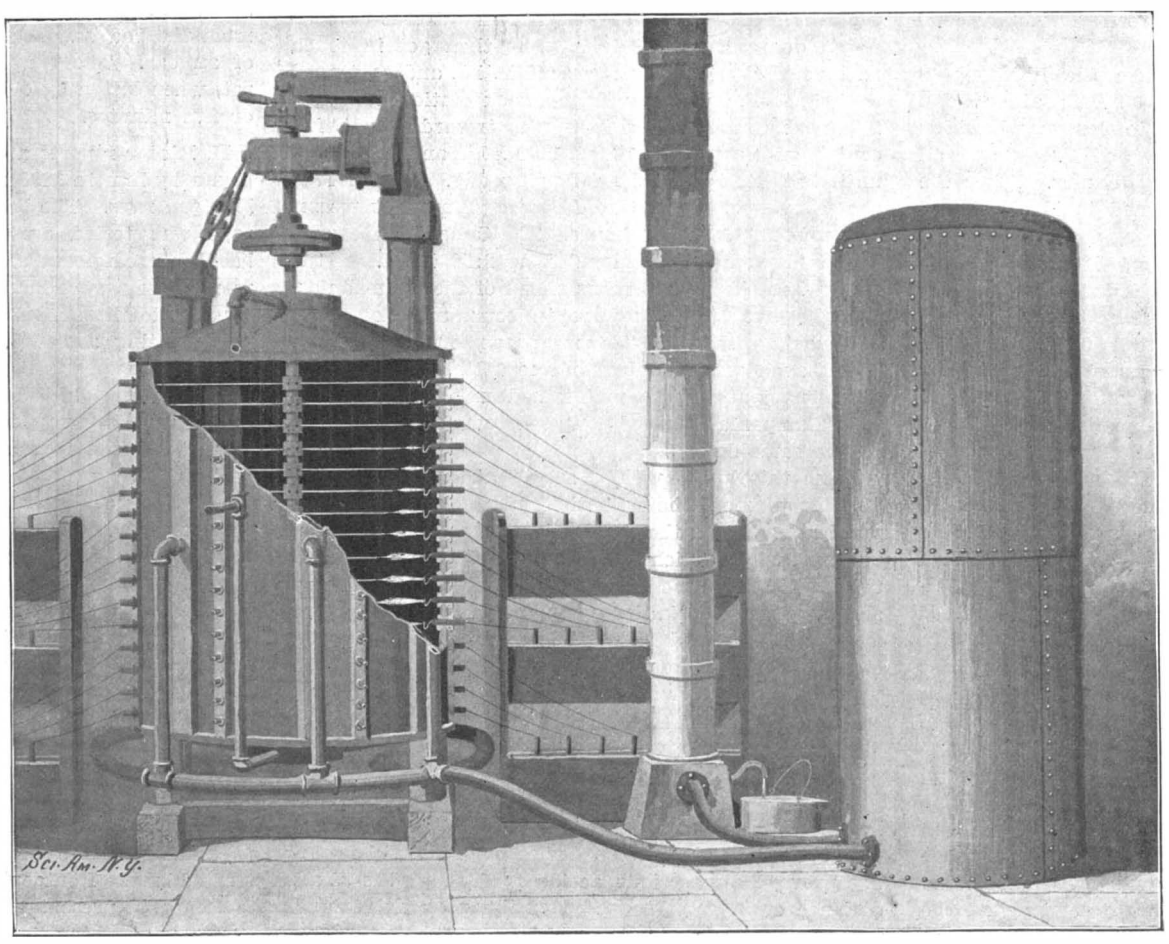


VIEW SHOWING INDUCTANCE COIL AND TERMINALS USED IN FORMING THE ARCS.

We show herewith several views of the machine which is the culmination of these experiments. Briefly stated, the apparatus comprises an air chamber in which electric arcs are formed between series of stationary terminals and series of revolving wire fingers. The oxygen and nitrogen of the air in the chamber are caused to enter into chemical combination by these arcs, and the resulting gases are drawn off to an absorption tower, where they are combined with various substances to form the required nitrates. Contrary to previous suppositions, the inventors found in the course of their experiments that alternating currents give unsatisfactory results, and so a large direct-current dynamo generating 10,000 volts was procured. This machine was slightly altered to comply with certain special requirements; for instance, it was found that the best work was done by a very slender arc of great length. It was, therefore, necessary to reduce the amperage to a minimum. The positive and negative poles of the dynamo are respectively connected in multiple with the revolving and stationary terminals. The flow of current is controlled by means of an inductance coil in each of the arc circuits, these inductance coils serving to subdivide the current from the dynamo. One of our illustrations shows the form of inductance coils used. The importance of these coils cannot be overestimated, and the greatest care is exercised in their proper adjustment. Each coil comprises 20,000 turns of fine wire and has a self-induction of approximately 150 henries. The coils are submerged in tanks of oil which are arranged in groups radiating from the combustion chamber, the oil being used to insulate the coils. The current in passing through these inductance coils is reduced to any required small value, 0.005 ampere being the amount which is used in this case. The stationary terminals are arranged in the combustion chamber in six vertical rows passing through insulating bushings. Wires from these terminals may be seen leading to the inductance coils. The revolving terminals consist of wire arms extending radially from a center shaft. These wire arms or fingers correspond in number to the stationary terminals and are symmetrically grouped about the shaft in six spirals of one sixth of a turn each. By reason of this arrangement the contacts are made successively in series of six at a time. The revolving shaft is driven by a small motor at the top of the machine, at a speed of 500 revolutions a minute. Thus it will be seen that each finger makes 3,000 arcs a minute. Immediately to the left of each row of stationary terminals is a recess or channel formed in the wall of the chamber. A metal deflector covers the inner face of each channel, leaving a small slit through which the gases resulting from combustion of the air are admitted into the channels and led away into the absorption tower. Fresh air is supplied to the chamber through pipes opening therein at the upper and lower bearings of the central shaft. The purpose of this arrangement is to afford an even distribution of the air and incidentally to cool off the bearings of the shaft. The air before being introduced into the chamber must be thoroughly dry, otherwise the moisture it contains is liable to unite with the gases while still in the combustion chamber to form nitric acid, which would attack the metal parts, break down the insulation, and do considerable damage to the machine. At present the moisture is absorbed by passing the air through calcium chloride, but in the new plant which is now being built desiccation of the air will be accomplished by refrigeration.

In the side wall of the combustion chamber are a number of "bull's eyes," or glass-covered openings, through which the observer may watch the arcs. As each wire finger reaches a stationary terminal a small blue spark jumps across the slight intervening air gap, and a flow of electricity ensues, forming an arc which is rapidly drawn out by the rotating terminal to a length of seven or eight inches before breaking. The nature of the arcs is governed by the inductance coils, which at first resist the current and later add their own energy to prolong the arc. When the machine is first started, the arcs give a comparatively white light, but this gradually changes to a reddish hue as the gases are formed. Intense heat is, of course, produced, and it is necessary to tip the terminals with platinum in order to prevent them from wasting away. The purpose of leaving a slight air gap between the negative and positive terminals is to prevent frictional wear, which would require constant readjustment of the parts.

Possibly some of our readers may have noticed that the stationary negative terminal is provided with a comparatively heavy platinum wire, while a very fine wire forms the tip of the positive terminal. This is due to a very curious phenomenon. We all know that the positive carbon in the ordinary arc light is more intensely heated than the negative pencil. It was found that at a certain small value of the current this difference of temperature was reversed, so that the negative became hotter than the positive. This phenomenon was first noticed by Prof. W. H. Freedman, of the University of Vermont. The air as it is burned by the electric arcs forms nitric oxide (NO), which immediately combines with another portion of oxygen and forms nitrous anhydride (N_2O_3). The chemical actions are usually slow, and in order to permit the combination to properly take place the gases are first passed through a large chamber, shown at the right in our illustration, before being drawn up into the absorption tower. The absorption tower is built up of a number of tile-pipe sec-



Combustion chamber. Absorption tower. Intermediate receiving chamber.

GENERAL VIEW OF THE APPARATUS—COMBUSTION CHAMBER PARTLY BROKEN TO SHOW INTERIOR DETAILS.

© 1902 SCIENTIFIC AMERICAN, INC.

tions, and in the formation of nitric acid it is filled with coke. Through this the gases are slowly borne by means of an exhaust fan at the top of the tower, and are brought into contact with water, which trickles down through the coke. Nitric acid (HNO_3) is then formed by the following reactions when the gases are warm: $3\ N_2O_3 + H_2O = 2HNO_3 + 4NO$. The latter product unites immediately with oxygen as follows: $NO + O = NO_2$. This in turn unites with water and forms another portion of nitric acid: $2\ NO_2 + H_2O = HNO_3 + HNO_2$, while the latter product breaks up according to the following equation: $3\ HNO_2 = HNO_3 + 2\ NO + H_2O$. The two molecules of nitric oxide (NO) will then repeat the cycle, beginning at the second equation. If the gases are cold a more simple reaction takes place, and nitrous acid is formed as follows: $N_2O_3 + H_2O = 2\ HNO_2$. This, however, is a very unstable acid and at ordinary temperatures decomposes, as in the fourth equation above, to form nitric acid, nitric oxide and water.

In the production of fertilizer the gases are combined with lime to form calcium nitrate. This is a far better fertilizer than sodium nitrate or Chile saltpeter now on the market, first because there is danger of injury to plant life when the latter is used too freely, owing to the presence of soda, which burns the roots of the plants, and second because lime (which the soil needs) is liberated from the calcium nitrate, instead of soda, which is the result of the decomposition of nitrate of soda (which the soil does not need and which is positively injurious). The cost of producing calcium nitrate according to the process described is less than one-half the present cost of sodium nitrate. In their endeavor to reduce the cost of production to a minimum, Messrs. Bradley and Lovejoy found that the output of the machine is governed by the following three considerations: First, the amount of electric current, which as previously stated, gave the best results at between 0.001 and 0.01 ampere; second, rate of air current passing into the chamber, since too rapid a flow would result in the chemical combination of only a small portion of nitrogen and oxygen of the air, while too slow a flow would permit the gases to pass a second time under the influence of the arcs and dissociate the compounds previously formed; third, the amount of oxygen in the air, the best results being obtained when the gaseous mixture is composed of approximately equal portions of oxygen and nitrogen. Notwithstanding the fact that the machine is already a commercial success, experiments have not ceased. The inventors are thoroughly testing all details, and are busy working along new lines which are constantly presenting themselves.

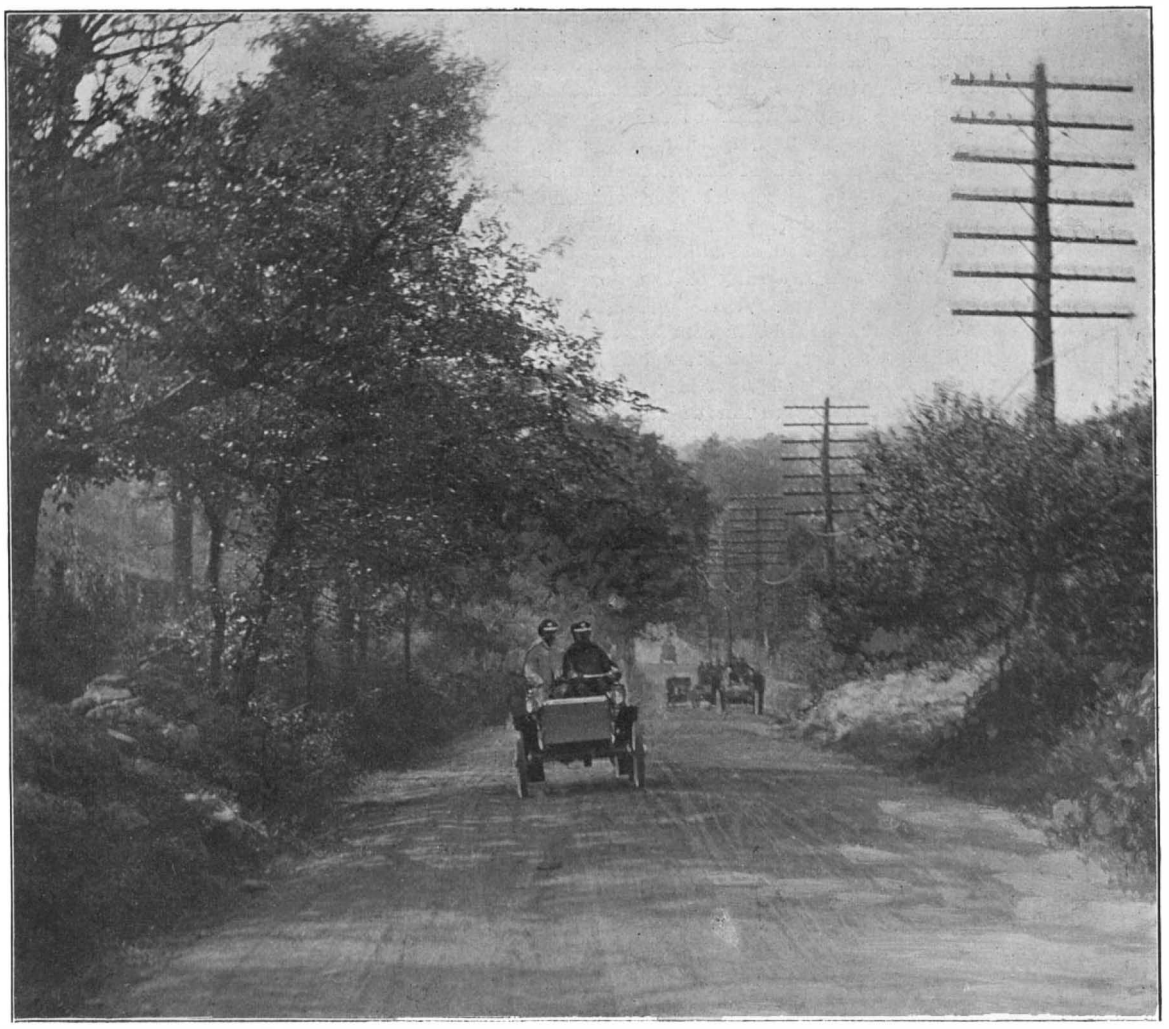
The first Pacific third rail system was opened in August. The road extends between Riverside and Van Asselt, California, for a distance of about six miles. Throughout the trial run a speed of fifty miles an hour was made.

NEW YORK-BOSTON AUTOMOBILE RELIABILITY TEST —THE FIRST DAY'S TRIP.

Under a cloudless sky and in the bracing air of a fine October morning, seventy-five of the seventy-eight automobiles entered in the Reliability Test started north on Fifth Avenue from Fifty-ninth Street in this city at 9 o'clock, for New Haven, Conn. The vehicles began the journey at thirty-second intervals by the official timekeepers, stationed at Fifty-eighth Street, and soon formed quite a procession as far as the eye could reach. The operators and observers as a rule had their eyes protected by goggles, while many of the experienced chauffeurs were dressed in the typical dust, dirt and rain-proof black leather suits.

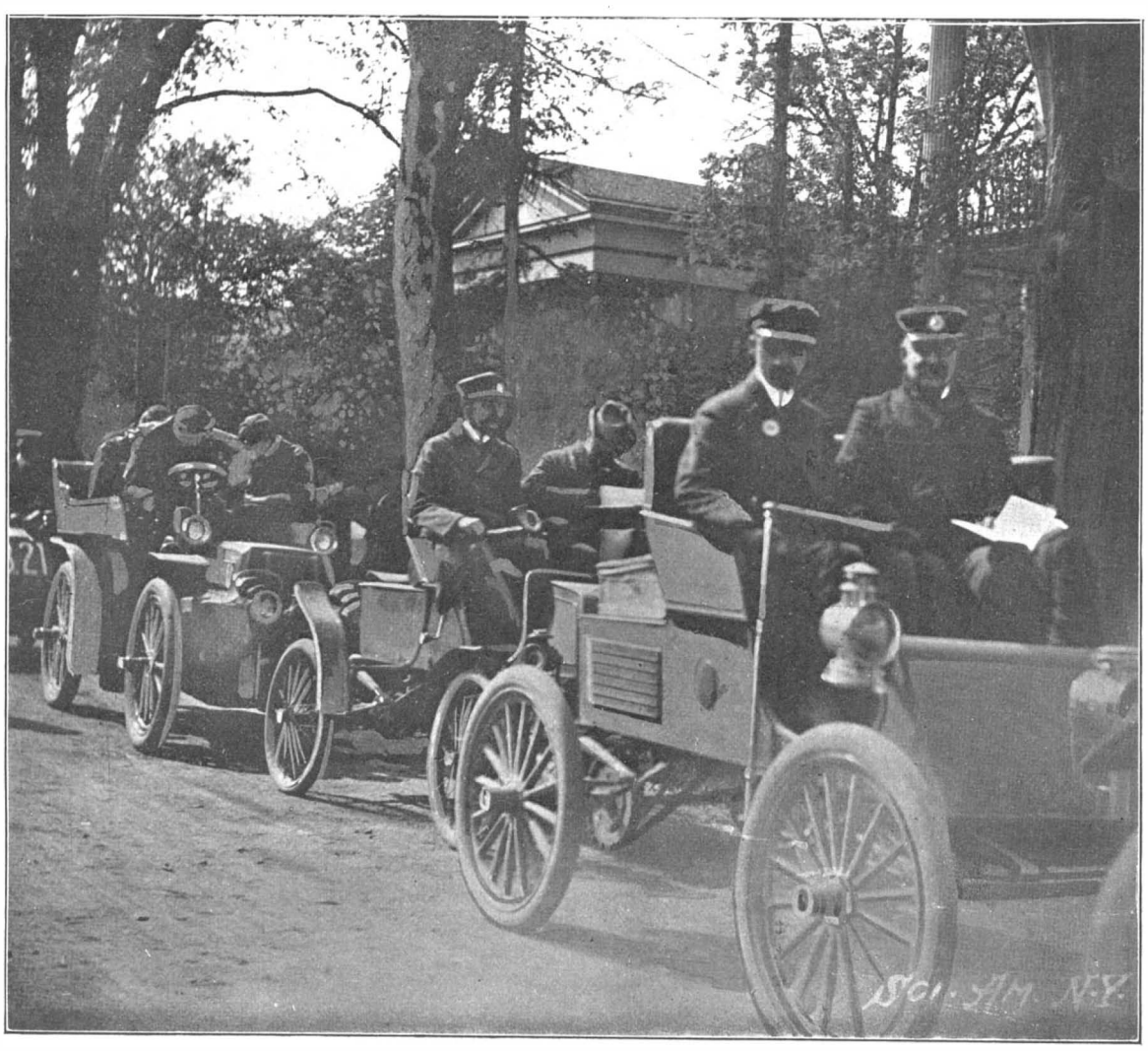
The route followed was north in Fifth, thence west to Seventh Avenue and via Jerome Avenue to Fordham, then east across to the Sound Shore Road, northeasterly into New Rochelle. From here the old Boston Post Road was followed through the various cities and towns to New Haven, Conn. The first forty-four miles to Norwalk, Conn., where the first control was stationed, were scheduled to be covered in three hours and ten minutes, which constituted an average speed of 14 miles per hour.

The Knox carriage, in which the writer and observer traveled, was one of three of that kind entered in the run. The novel feature of this machine, as illustrated and described in the SCIENTIFIC AMERICAN of March 1, 1902, is an eight horse power air-cooled motor which has numerous heat-radiating pins screwed into the outer wall of the cylinder, upon the head of which a fan, driven by a pulley on the two to one cam-shaft, is constantly blowing. The radiating surface is much greater than that obtained on motors of the flange air-cooled type, while the fan serves to keep the valves and valve springs reasonably cool.



MOUNTING BYRAM HILL, GREENWICH, CONN.--SIXTEEN PER CENT GRADE.

Starting among the foremost of the contestants, two of these machines kept together throughout the whole first day's journey, and all made a perfect record. Not a stop was recorded against them in either of the two stages, and the two that kept together were on time to the minute at the noon and night controls. No bad roads were met with during the entire day's run, though several bad hills were encountered in the vicinity of Greenwich and Norwalk, Conn. Our illustrations give an excellent idea of the train of automobiles mounting the long sixteen per cent grade at Byram Hill, in the town of Greenwich, and the way in which the vehicles were lined up for starting on the second half of the journey at Norwalk. The Knox machines climbed these without perceptible effort, and the low gear was not resorted to in any case till two-thirds of the hill had been traversed. One or two long and rather steep hills, where a good start was obtained, were ascended entirely on the high gear, without once throwing out or "jockeying" the clutch; and on the whole the Knox motor developed fully as much power as any water-cooled motor of its size, and an abundance for propelling its 1,300-pound carriage up the steepest grades. The many advantages and the simplicity of the new system are obvious, and need not be dwelt upon here.



LEAVING NORWALK, CONN.—THE FIRST CONTROL STATION.

By means of a table giving the times at which the different towns should be reached, it was possible to keep close to an average speed of fourteen miles an hour. It was difficult to hold to this speed, which seemed very slow on the smooth stretches of road, especially when many of the more eager contestants would now and then speed past. We were some minutes ahead of our schedule after passing through Stamford, Conn., and so, in company with many others, we were obliged to "lose time" during the last few miles, in order not to exceed our minimum time limit. We passed about a half dozen cars in trouble from punctured tires throughout the entire morning's run; but there were no genuine breakdowns noted, all the machines arriving at Norwalk. A Packard heavyweight car had a tire give

© 1902 SCIENTIFIC AMERICAN, INC.

out a few yards before crossing the line at the noon control. Another car that had tire troubles was the huge locomotive racer of S. T. Davis, Jr. The locomobile gasoline touring car was driven by its designer, Mr. A. L. Riker, and reached both controls on time, without any mishaps. Three White steam stanhopes and two White delivery wagons arrived safely at the finish, and all the well-known firms, such as the Winton, Haynes-Apperson and Oldsmobile Company, were represented by two or more of their cars. Among the new machines that reached New Haven successfully were the Rambler, the Stevens, Duryea, the Fredonia, the Elmore (driven by a two-cycle engine) and the Autocar tonneau. A combination gasoline-electric car entered by Knight Keftel, owing to a defective water circulation in its gasoline engine, became overheated and did not reach Norwalk for three and a half hours after the others. The battery was kept charged en route by the gasoline motor and generator. The contesting carriages were mostly of the gasoline and steam types only. The first vehicle to reach the New Haven control was a De Dion run by Kenneth A. Skinner. Seventy-two vehicles out of seventy-five starting from New York reached New Haven. Each observer is provided with a specially-arranged note book having pages of sectional maps explaining the route and other pages for noting mishaps and delays that may occur. The contest began on Thursday morning, October 9th, and occupied three days from New York to Boston, resting there over Sunday. The return to New York was made on Monday, October 13th, taking three days and was concluded in New York on the 15th inst. The distance traveled was 488 miles.

Reports of the second day's run, October 10th, from New Haven, Conn., to Springfield, Mass, sixty-nine miles, state that out of seventy-three leaving New Haven seventy-one reached Springfield. The Knox machine, on which the writer rode, broke its crank shaft before reaching Hartford and a Haynes-Apperson machine in running rapidly into a sand ditch at one side of the road in avoiding a rear collision with preceding vehicles broke both front spring hangers, which caused the front of the body to fall on the gear, making a peculiar looking appearance. There were numerous brief delays to other vehicles caused by punctured tires or defective sparking plugs. The first to arrive at Springfield was a Packard, time from New Haven being 3 hours, 11 minutes, 45 seconds. In the evening a banquet was given the travelers by the Knox Vehicle Co. at the Cooley House, Springfield. The third day's run from Springfield to Boston on the 11th was successfully completed, sixty-nine machines reaching there on time.

The French Naval Department is constructing a new type of submarine boat, the invention of Lieut. Boulin, commander of the submarine "Triton." This craft is entirely different in its general design from all existing submarine war vessels, inasmuch as it is practically a submersible armorclad. The boat, which is of much greater dimensions than the present submarines, resembles a small cruiser, is propelled exclusively by steam power, and is replete with powerful quick-firing guns. When submerged it is not entirely obscured beneath the water, but the upper portion of its funnel is shown above water, and this, being painted gray, is visible only at short distances. To attack, the boat emerges from the water, launches its torpedo, discharges its guns, and again descends into the water, leaving only its funnel to be fired at, the water forming an excellent protection to the hull, which is built of chrome steel. This vessel is to be constructed at Cherbourg and will cost $400,000.

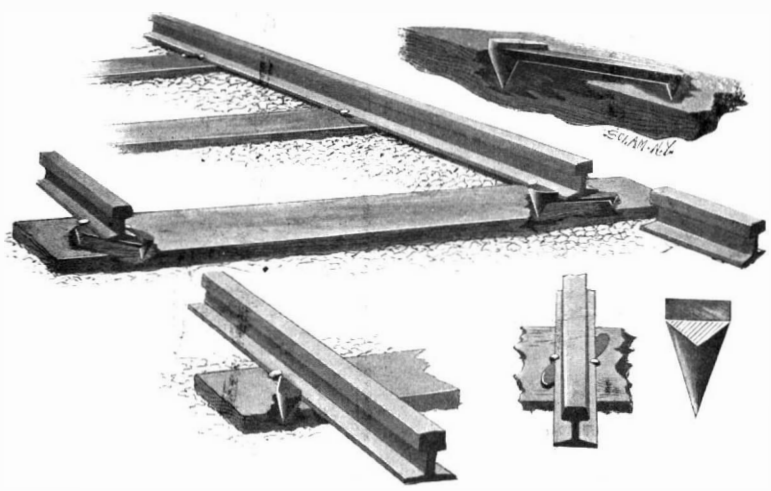
An attempt is being made in England to revise the standard of weights for commercial purposes. The suggestion is to create new weights of 50 pounds, 25 pounds, or 20 pounds, 10 pounds, and 5 pounds avoirdupois, respectively, to run concurrently with the hundredweight series of weights. The corn, cotton and tobacco trades have adopted the cental system, but it is necessary to make up the cental to use the 56-pound, the 28-pound, the 14-pound and the 21-pound weight. If two sets of weights are used, one based on the hundredweight and the other on the cental, confusion can be avoided by making the new weights, or otherwise plainly distinguishing between the two series of weights. This new system is averred to be imperative in order to accelerate and make British trade easier than it is with the antiquated system of hundredweights, quarters and pounds. The proposal is being enthusiastically supported and there seems every possibility of its coming into vogue.

The new balloon for Mr. Santos-Dumont, the construction of which has been begun, will be 25 meters long by 11 meters in diameter, and will carry two aeronauts and eight passengers.

IMPROVED RAIL-BEARING PLATE.

The increasing weight of our railway freight and passenger trains is presenting new difficulties to civil engineers. The mammoth locomotive of to-day is too heavy for the track construction of yesterday. New devices must be provided for securely holding the rails, for firmly spiking the rails to the ties, and above all for protecting the ties themselves against the crushing pressure to which they are subjected. Neglect in any of these particulars will result in the spreading of the rails and causing accidents of serious proportions. The truth of this statement is proved by the large number of railway accidents due to spreading rails; and, further, the patent records show that the attention of inventors has been, to an increasing degree, directed to the solution of these difficulties.

A device which is adapted to positively hold the rails against sidewise movement and to entirely prevent crushing of the ties has recently been invented by Capt. V. E. McBee, fourth vice-president of the Seaboard Air Line, residing at Norfolk, Va., and who as a civil engineer has had the advantage of a thorough and practical acquaintance with the construction and operation of railways. His invention, which is herewith illustrated, consists of a steel plate of general triangular cross-section, having a prong or spike projection at each end and a boss or heel on the upper surface for engaging the rail flange to prevent spreading. These rail-bearing plates are driven into the ties diagonally to the direction of the track, so as to combine as large a bearing surface as possible for the rail with the most economical use of metal. At the same time this diagonal disposition across the grain of the tie prevents displacement due to splitting of the wood; and the V-shaped under surface of the tie plate being embedded into the tie makes it noiseless and gives additional security against the spreading of the rails. In practice it is found best to alternate the positions of the tie-plate so that the heel or retaining lug abuts alternately against the inner and outer edges of the rail flanges. One of the serious objections to flat tie plates, now often employed, is their tendency to buckle under the heavy loads they are required to sustain, thus offering practically no protection to the ties, with the result that a large sum must be expended annually to renew ties which have been badly crushed. In this device, however, no buckling is possible, because of the heavy triangular cross-section of the bearing plate. These tie plates because of their simple construction may be very economically manufactured, and the initial expense of equipping a road with them is soon repaid by the increased life of the ties.



IMPROVED RAIL-BEARING PLATE.

Treatment of Roads with Gas Tar.

While roads in the United States have been treated with crude oil to lay the dust and render them compact, in Italy the same end has been attained by using gas tar, and the experiments which have been made seem to be quite successful. M. G. Rimini, the district engineer at Lugo, near Ravenna, has published an account of the application of gas tar to some sections of the public road in that locality. He uses it in two different places on the provincial route near Lugo, where the circulation is very active. The first portion treated measures 40 feet long and 10 feet wide and the second 750 feet long and 13 feet wide. In spite of the prolonged dryness, the results of this treatment have exceeded the expectations, and the surface of the road has become very hard and compact, so that it is difficult to pierce it. There is no dust, and the rainwater flows off without penetrating, and thus there is no mud formed. The color of the soil becomes that of a very dark sand. It is not necessary to treat the whole surface of the road, but only a band in the middle about 12 feet wide. As to the cost of the treatment it is estimated at only $96 per mile. M. Rimini is making observations of the two sections thus treated before applying it on a larger scale.

The Piscicelli Taeggi Electric Post.

News comes from abroad that the Italian government is considering a scheme for the transmission of mail matter by aerial electric railway at a speed of 250 miles an hour. The inventor, Signor Piscicelli Taeggi, has filed an application for a United States patent.

The aerial track over which the mail is to be transmitted consists of four wires which also act as conductors. The top wires will carry the motor or driving wheels, and two lower wires will support the wheels of the mail-boxes. High-tension three-phase current at 3,000 volts, stepped down to a potential of 260 volts, is to be fed to the two top wires and one of the lower wires, for supplying the motors of the mail boxes.

In order that one mail-box may not come within the block occupied by another mail-box, the step-down transformers will be located three or four miles apart. The preceding mail-box will cut off all current on the block immediately behind it. In order to attain this end the second or lower wire is used.

The supporting wheel of the mail-box in the preceding section having completed the circuit in the two lower wires, a current is allowed to pass through the magnetic coils of an automatic circuit-breaker, thereby shutting off the current from the section which it serves. When the mail-box enters the next section-head, the previously cutout section is again well supplied with current, and that immediately behind it rendered inoperative.

A mail-box traveling at the rate of 250 miles an hour acquires an enormous momentum. It therefore becomes a matter of considerable importance to devise means to cut down the speed. The inventor intends to cut off the section in advance of any station from any current by means of station switches, so that the momentum of the mail-boxes will be used only for a certain stretch. In addition, a braking device is employed. The mail-boxes are to be made of aluminium.

Signor Piscicelli Taeggi likewise has devised a system of collecting poles and boxes, as well as an apparatus for stamping the letters with the day, hour and minute of posting. Poles are also provided which act as transformer boxes, as well as supporters of the permanent way.

The letters can be dropped into receptacles, by which they are carried by an electric elevator to the top of the pole, where they are emptied into the mail-boxes.

In criticising this scheme, Mr. William Dig by in a recent number of Engineering says that although previous schemes of the same nature have not been altogether successful, nevertheless the remarkable advances made in electricity in recent years may be relied upon to overcome many of the difficulties which will naturally be encountered. He entertains grave doubts, however, whether the speed of 250 miles an hour can become an economic possibility, even if the difficulties of current collection at such speed should be overcome.

How long the aerial system would stand the strain of the mail-boxes' running at immense speed over the positions where the supporting and conducting wires are fixed, is a question that must give electrical engineers pause. Sparking and breakages of trolley wires at such points are among the minor troubles to be expected. When one remembers, too, how much of the vibration in railway trains is due to the spring of the rail ends at the fishplates, it will be recognized that any accentuated form of vibration along an aerial electric railway, with its saggings between insulator and insulator, would be fatal to its success.

The Current Supplement.

The current Supplement, No. 1398, contains as its leading article a fully illustrated account of a novel electric power installation near Butte, Montana. Another electrical article describes the electrolytic manufacture of zinc. Just now the question of using oil as fuel is one that is uppermost in the minds of engineers. For that reason Mr. Edwin L. Orde's exhaustive paper on "Liquid Fuel for Steamships" will prove of unusual interest. Dr. Peter T. Austen, well known as a chemist of rare ability, writes interestingly of the chemical factor in human progress. The launch of the cruiser "Des Moines" is a subject that will appeal to our naval readers. Prof. Dewar terminates his scholarly "History of Cold and the Absolute Zero." The eruptions which have devastated Martinique and St. Vincent, as well as the telluric disturbances which have occurred in other parts of the world, render an article on volcanoes particularly timely.

Capt. Sverdrup, who returned from the Arctic regions soon after Lieut. Peary, narrates his experiences in search of the North Pole.

It is stated that the largest steel plate ever rolled was one recently turned out by the Parkgate Works, England; it is 30 feet long, 10 feet 6 inches wide and seven-eighths of an inch thick.

© 1902 SCIENTIFIC AMERICAN, INC.

THE LATEST BRITISH ARMORED CRUISER "GOOD HOPE."

Great interest attaches to the fine armored cruiser which forms the subject of our front page engraving, from the fact that she is the first of a class of extremely fast and powerful armored cruisers which are now under construction for the British government. The vessel is really an improved "Powerful," with all the good points and none of the defects of the "Powerful" and "Terrible," and with certain added excellencies which render her probably the best, all-round fighting ship that has ever been turned out from the English yards.

The "Powerful" and "Terrible," launched in 1895, were at that time by far the largest and swiftest cruisers afloat. They had the defect, now well recognized, that they depended for protection entirely upon an armored deck, no vertical side armor whatever being provided; while their armament was a weak one relatively to the great displacement of 14,200 tons. They showed on trial a speed respectively of 22.4 and 22.1 knots an hour. Their best feature was their enormous coal capacity, 1,500 tons normal, and 3,000 tons bunker capacity. The "Good Hope" and her sister vessels, the "Drake," "King Alfred" and "Leviathan," have practically the same dimensions, viz.: Length, 500 feet; beam, 71 feet; draft, 26 feet, and displacement, 14,100 tons. They have, however, a belt of side armor of Krupp steel which is nearly 400 feet in length, extending from the bow aft. For 280 feet of this length the belt is 11 feet 6 inches broad, and from 6 to 4 inches in thickness. At the forward end the belt increases in width to 24 feet, the thickness being reduced to 2 inches. At the after ends of the belt there extends from side to side a bulkhead of 5-inch steel, the after 105 feet of the ship, though it is without vertical plating, being protected by a 2½-inch deck, which shelters the steering gear and magazines from shell fire. To the vertical side armor protection there is added two protective decks, the upper one 1½ inches in thickness, the lower one 1 inch in thickness.

As compared with the "Powerful," the "Good Hope" has about 1 knot more speed, to attain which the indicated horse power, as named in the contract, has been raised from 25,000 to 30,000, and, unlike the earlier ships, the "Good Hope" more than fulfilled the expectation of her designers; for on an eight-hour full power, steam-trial in the English Channel, she maintained an average speed, as a mean of five runs, ot 23.05 knots per hour, the mean collective indicated horse power beng 31,071.

In point of armament the "Good Hope" is, in general, similar to the "Powerful," with the important exception that she carries four more of the effective 6-inch rapid-fire guns, her total armament being as follows: Two 9.2-inch guns mounted one forward and one aft on the upper deck and protected by a 6-inch shield and barbettes. Sixteen 6-inch rapid-fire guns of the new Vickers' type carried in eight, two-storied armored casemates; twelve 3-inch rapid-fire guns, besides several smaller rapid-firers distributed on the bridges and superstructures. The coal supply is generous, consisting of 1,250 tons normal and a full bunker capacity of 2,500 tons.

It is interesting to compare this cruiser with our own armored cruisers of the "West Virginia" type, which on a displacement of 420 tons less have the same thickness of armor protection except the deck, which is about an inch and a half heavier; one knot less speed; about 500 tons less coal capacity, but which carry a somewhat heavier armament, consisting of four 8-inch, fourteen 6-inch, eighteen 3-inch and twelve 3-pounders, besides several lighter rapid-fire guns. The two new armored cruisers which are to be laid down for our navy this year and are as yet, we believe, unnamed, are considerably more powerful than the "Good Hope." They are of 14,500 tons displacement, 22 knots speed and will carry a complete belt which, with the shield and barbette protection of the guns, will be considerably heavier than that on the "Good Hope." The armament, moreover, will be much more powerful, including four 10-inch guns carried in pairs in two barbettes, one forward and one aft, on its upper deck, and sixteen 6-inch guns, carried behind what will probably be a complete wall of side armor, extending from the belt to the upper deck. Added to these will be over twenty of the effective little 3-inch rapid-fire guns. The normal coal supply will be 900 tons, and the total bunker capacity 2,000 tons. So powerful will be these new cruisers that they may well be included in the battleship class, since many of the foreign battleships carry 10-inch guns in their main barbettes and the latest battleships of the German navy have nothing heavier aboard than the 9.45-inch gun. Altogether these new cruisers of our navy promise to be the most effective fighting ships yet turned out by our designers, in which respect they will hold the same position in our navy as is held in the British navy by the fine vessels of the "Good Hope" class. It should be mentioned in closing that this vessel was presented to the British government by Cape Colony, and hence its name. We are indebted to the builders, the Fairfield Company, of Glasgow, for the illustrations of the ship and engines.

Automobile News.

After five days' trial a jury in the United States Circuit Court on October 7 awarded $12,070 damages to Joseph B. Hughes, of New York, in his suit against Felix Warburg. Mr. Hughes collected damages for injuries sustained by the running away of his horses, which were frightened by Mr. Warburg's automobile at Seabright, N. J. One of the horses was killed and Mr. Hughes permanently injured. Mr. Warburg himself was not in the automobile at the time of the accident.

In one of the leading English periodicals Mr. B. H. Thwaite, C. E., projects an automobile highway from London through the center of England to Carlisle, and thence to Glasgow, Edinburgh and Inverness. The road would have a foundation of concrete and a surface of specially hard creosoted wood blocks with asphalt joints, the surface curvature being sufficient for thorough and rapid drainage. Its central portion would be used exclusively by motor cars, and there would also be side paths for bicyclists. Mr. W. K. Vanderbilt, Jr., is authority for the statement that a similar road is soon to be built in this country from Long Island City to Roslyn, a distance of twenty miles. This road will be entirely on private ground, and will be designed for speeding purposes mainly.

The many accidents recently from fast speeding in France have caused Mons. E. Hospitalier to give, in La Locomotion, some interesting facts as to the inertia of a 2,000-pound automobile traveling at the rate of 75 miles an hour, and the braking power required to stop it. Calculation shows the inertia of the vehicle to be no less than 60,000 kilogramme-meters, or the same that it would have if it fell a distance of 196 feet, the height of the towers of Notre Dame Cathedral. This energy is equivalent to that of a complete train on the Paris underground railway, traveling at its highest speed of 21¼ miles an hour. When a brake is applied capable of a resisting effort of 551 pounds per ton at the rim of the wheels, the retarding power of this brake is, during the first instants, equivalent to 113 horse power. The mean power developed by the brakes while they are applied reaches nearly 60 horse power. And all this terrific strain is transmitted through the frail pneumatic! The wonder is that the tires stand up as well as they do, and that accidents caused by their bursting are, comparatively, so few and far between.

One of the great troubles that automobilists have to contend with is loose nuts on their machines. Mr. Vincent C. Bryce, an experienced mechanic, patented some two years ago a special form of lock nut in which are combined the principles of the lever, the screw and the wedge. The nut is in two parts, an inner tapered core that screws on the bolt and an outer shell that fits over the inner core. The two pieces fit together and form one nut, which can be screwed in place or unscrewed as easily as an ordinary nut, but will never work loose. The nut has been tried on some of the Pennsylvania Railroad locomotives for fastening connecting rods, and has proved an unqualified success. We have also tested a number of them on a gasoline automobile, and found them all that they are claimed to be, and a boon to all chauffeurs. The Columbia Lock Nut Company, of Bridgeport, Conn., are the manufacturers.

A commission of Belgian army officers has recently tested a new automobile tractor which is to be used in the Congo region over the Songololo-Popokabaka route, which was laid out by Commandant Carton with 300 native laborers. The vehicle weighs 3.3 tons empty and will carry a 2-ton load, or 60 packages of the type usually made up for Central Africa, weighing 65 to 75 pounds each. The tires of the rear wheels are 16 inches wide. Control of the vehicle is easy and a speed of one mile in 8.3 minutes is reached. The principal tests were made at Ensival, and the vehicle covered a distance of 13 miles, the steepest grade being 14 per cent. In these trials 5.5 gallons of an alcohol and gasoline mixture in equal proportions were consumed. The consumption was about 0.4 gallon of combustible per mile with a load of 5 tons gross, or 2 tons net, making a cost of $0.013 per ton-mile of gross load, or $0.03 for net load. The distance from Songololo to Kwango is 180 miles, this being the route to be covered, and allowing a speed of 3 miles an hour during 10 hours per day, it would require 6 days to make the single trip. The round trip will therefore require about two weeks, counting the time of loading and unloading, or per year the vehicle can make 24 trips. If this automobile is found to work successfully on the road, there is no doubt that others will be added, and it is estimated that six of these tractors would transport at least 150 tons annually, which would be a great benefit to the traffic of the region.

Correspondence.

The Spider at Work.

To the Editor of the Scientific American:

Two interesting articles in late issues of your journal prompt me to state that I have made many efforts to ascertain how a spider spins his web from one tree to another.

Spiders are very shy and work mostly at night. Hence my efforts were fruitless for a long time. Finally I captured a spider and confined him in a glass jar. I fed him bountifully, and gave him such attention as to quiet his fears. Often I would take him out into the open air and observe his actions.

If it were cool, damp or windy weather, he would reluctantly leave his quarters. But if it were warm, dry and calm, he readily came forth, and his excited, eager actions gave evidence of the possession of that innate love of liberty peculiar to all animated creatures. On such occasions he was ever upon the alert to escape. I carried him upon my hat or walking cane, held out horizontally.

He would attach a web to the cane and then drop like a flash in order to escape. I always anticipated him and thwarted his plans. He would hang by the web, which he knew would sustain his weight, until I rescued him. I am satisfied that he estimated the distance to the ground, and that he would have succeeded in escaping had I not raised the cane. He would climb up his web and at the same time roll it up. Often I saw him take up a web, roll it into a pellet or ball and store it away, presumably for future use. He seemed to shrink from sunshine, preferring a dense shade, and refused to work while the wind was blowing.

His actions were most interesting when I would cast a living fly into his quarters. Cautiously he would approach it, dexterously capture his prey, and bind him, I believe, with bits of web formerly used and stored away.

In favorable weather he would raise his head and turn to every point of the compass. Whenever I approached a bush he would become excited. I have always believed that spiders depended upon currents of air to transport their cables, but I lacked the proof. Finally my patience and persistence were rewarded. One day, about four o'clock in the afternoon, when the thermometer stood at about 85 degrees in the shade, and the air was so calm that I could not feel any current, although there was a slight movement in the air from northeast to southwest, I selected a place about 12 feet from a wire fence with green bushes in the rear. Here I had the benefit of the sunlight to observe my spider. His actions proved that he appreciated the favorable situation at its true worth. Poised upon the end of my cane, he set his spinneret in motion. I could see the web floating away with every undulation, glistening in the sunlight as it went on directly to the wire. When it caught the spider stopped immediately. His subtile sense of touch told him of his success. Forthwith he began to haul away on his cable until it was taut and fastened to the cane. Then he went over the tight web like one who loves liberty and values time. I thought he had earned his freedom, and likewise that I had gained the information which I so much desired.

W. T. Hollis.

Rison, Ark., September 26, 1902.

The Besetting Perils of Venetian Structures.

A correspondent of the London Times has made some astonishing statements in an article on Signor Boni's work in restoring the monuments of Venice. He says that the church of St. Mark, the Doge's Palace, the Procuratie Vecchie, the Zecca, and the churches of Santa Maria Gloriosa, dei Frari, and SS. Giovanni e Paolo need prompt attention if they are not to share the fate of the Campanile. Although too much credence cannot be given to many of the wild rumors of the condition of Italian monuments, it can hardly be denied that the Campanile catastrophe has aroused justifiable distrust of the competency and diligence of Italian engineers. According to the Times correspondent, the Doge's Palace reveals diagonal lesions behind the bookcases of the Biblioteca Marciana; it seems as if the brickwork were tumbling inward. In the Procuratie Vecchie are several serious cracks, caused probably by the wholesale demolition of the internal walls and the stacking of heavy goods in the rooms above the colonnade. The correspondent comments on the folly of the civil engineer corps which is preparing to remove the Biblioteca Marciana to the Zecca. The latter building is already in a sorry condition.

If Venice should really lose these architectural monuments, her doom may be said to be sealed. Commercially, the city is of little importance. Venice has lived simply by reason of her artistic attractiveness; and when that is gone, it is doubtful if European tourists will visit the old city of the Adriatic.

© 1902 SCIENTIFIC AMERICAN, INC.

COAL STORAGE.

BY WALDON FAWCETT.

Recent conditions in the fuel market of the United States as brought about by a prolonged strike have directed renewed attention to the subject of the storage of anthracite coal. It has been apparent to a growing extent of late years that with an almost constant demand on the one hand and a varying production on the other, rendered necessary by the conditions at the collieries, a uniform supply can be secured only by the use of a reservoir of large capacity which will absorb the surplus or yield it up as conditions may demand. The methods commonly employed for storing anthracite coal may be divided into two general classes: Those which do not employ machinery and those in which machinery is employed. In the first-mentioned division is the side-hill storage system, the trestle systems with or without reloading tunnels, and the pocket system, while in the second class are embraced the systems which employ machinery in part as well as those in which all of the functions of a storage plant are performed by mechanical devices.

Prior to the introduction of machinery in coal handling operations the effort of all designers of storage plants was to make gravity the sole agent in reloading. In other words, the ideal sought was to store coal in such a manner and at such an elevation that it would flow by natural means into cars. As a result there were evolved the side-hill and trestle systems, various modifications of which are yet in use.

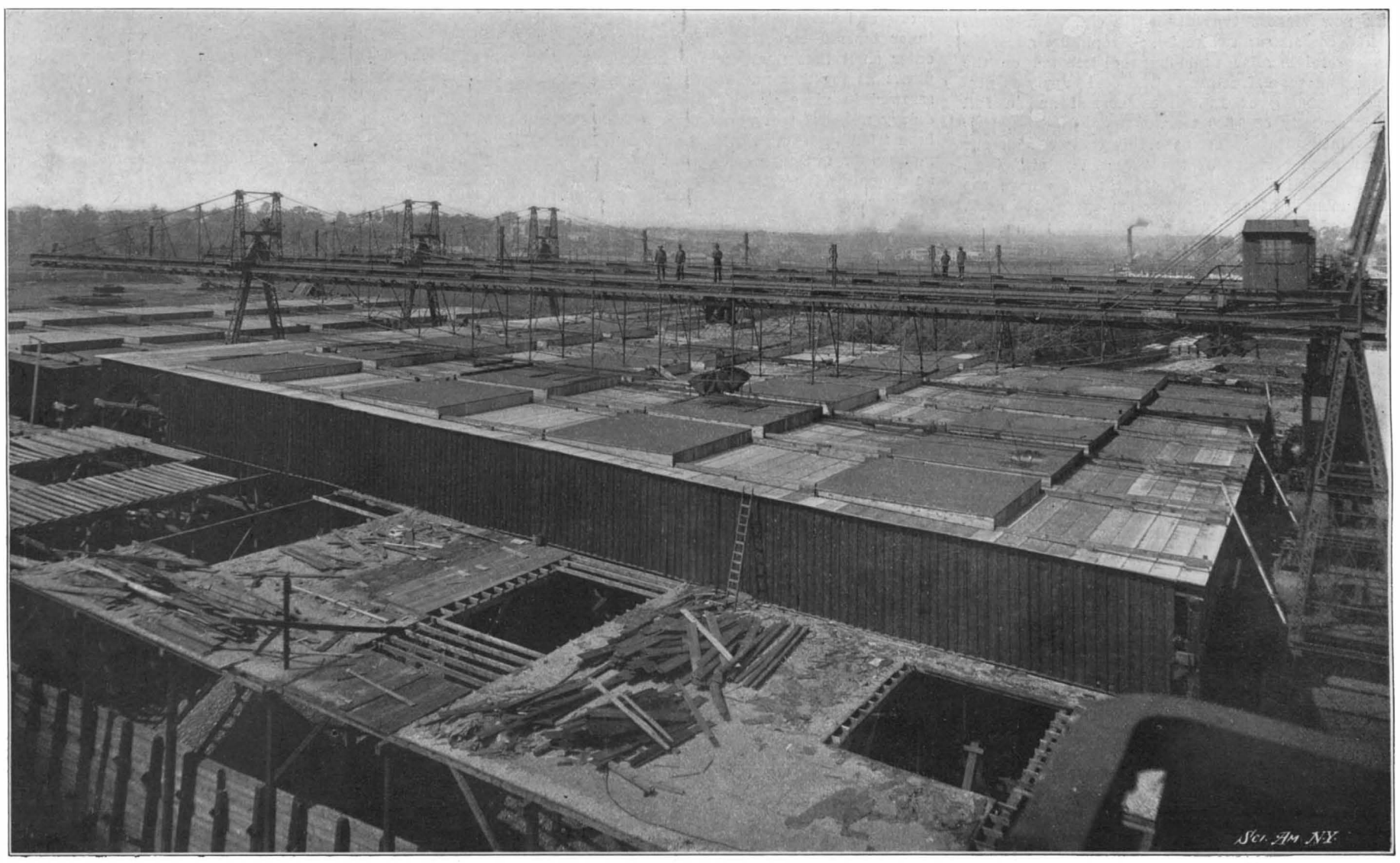
In the side-hill system the coal is stored on a hillside having a slope equal or nearly equal to the angle of flow of coal. A trestle on the hilltop carries a dumping or stocking-out track, whereas the reloading track is located in a trench near the foot of the hill. It was discovered, however, in seeking solutions of the coal storage problem that suitable hillsides were rather scarce, and as a result came the development of the trestle, which is usually built on an almost level area. In its earlier form the trestle system simply consisted of a series of dumping or stocking-out tracks carried on trestles of suitable height. No attempt was made to reload by gravity, all the coal being reloaded by hand. Later there was introduced an adjunct in the form of what is known as a central reloading tunnel. There are two different styles of reloading tunnel, one being located above ground and the other underground. The pocket system of storing coal is limited in its application almost exclusively to the handling of the fuel at shipping piers at tide-water. The coal-storage systems which employ machinery in part usually consist of installations in which the ordinary trestle system, already mentioned, is supplemented by reloading conveyors placed either in the tunnels or against the faces of the retaining walls. Obviously the most interesting coal-storage plants are those in which machinery is used exclusively. Prominent among these are the systems in which tubs and buckets are mounted upon movable bridge tramways or wire rope cableways. Machinery of this type is familiar to a majority of students of industrial progress, owing to its extensive utilization in the handling and storage of iron ore, particularly at the ports on the Great Lakes and at iron-working establishments in the so-called "Pittsburg district."

COAL-RELOADER OF THE DODGE TYPE.

Of late the efficiency of plants of this kind—all based on the inventions of the eminent engineer, Alexander Brown—has been greatly increased by various means. There may be mentioned, as contributing causes, the introduction of various types of grab or "clamshell" buckets, each capable of imprisoning from one to ten tons of coal by the closing of their iron jaws and bucket-shovels, which when drawn up the side of a pile of coal will automatically scoop up a load which equals the limit of their capacity. The latest and probably the most interesting innovation in this field, however, is found in the use of such machinery for the storage of coal under cover; the radical departure being found in the fact that the handling machinery is located in the open above the covered storage bins. Bridge tramways of excessive length span the great storage sheds, and the tubs or buckets carrying coal are lowered through hatchways in the almost flat roofs, just as they might be lowered into the hold of a ship loading or unloading at dock.

A marked advance in the coal-storage field is embodied in what is known as the "Dodge system"—a style of plant that is a radical departure from the older methods of storage. In this system the trimming or stocking out is done by conveyors arranged at angles equal to the angle of repose of the coal, and these conveyors receive the coal from cars and build it up into conical piles, beginning the delivery a trifle above the ground line and constantly advancing it to a point a little above the apex of the growing pile. The conveyor trough is constructed to permit this gradual advance of the delivery point, so that after the initial drop into the track hopper there is no further drop exceeding a few inches.

The reloading is accomplished by means of an open-side conveyor which works against the edge of the



A CONVEYOR USED FOR STORING COAL UNDER COVER.

© 1902 SCIENTIFIC AMERICAN, INC.

pile and follows up this edge as the coal is removed. The conveyor is mounted on a pivoted frame moved by power and so arranged as to be wholly under the control of one man. The reloading conveyor carries the coal without transfer to the reloading tower, where it can be delivered either directly into cars or else screened and then delivered into cars. A unit of this system consists of two trimming conveyors and one reloading conveyor arranged midway between them. For large capacities the dumping tracks are arranged on one side of the plant and the reloading tracks on the other. By this arrangement it is possible to carry on simultaneously the operations of trimming and reloading without any interference of cars or choking of tracks.

In the coal-storage plants of this new system each machine is of sufficient capacity to handle 1,800 tons in ten hours. In the operation of the plant of this character the coal received from cars in a hopper located beneath the receiving track is fed through a chute to the conveyor of the trimming machine, which delivers it upon the ground or at the apex of the pile as it forms. The bottom of this trimming conveyor is a steel ribbon, usually twelve inches wide, which is wound upon a drum located at the foot of the truss and arranged to be drawn out in grooves fixed in the conveyor trough, so that its end, which is the only discharge point for the coal from the trimming machine, shall always be at the constantly rising and receding apex of the pile. The reloading machine is composed of a horizontal and an inclined portion, both working together so as to render the carrying of the coal continuous from any point on the horizontal portion to the upper end of the inclined portion, where a small pocket is provided into which the coal flows and from which it is discharged over screens into cars or vessels.

This system of coal-storage is employed in the 180,000-ton plant of the Philadelphia & Reading Railway Company at Port Richmond, Philadelphia. However, the Scranton plant erected for the Delaware, Lackawanna & Western Railroad Company has the largest trimmers and the longest reloader yet constructed under this system. Each of the two floors holds 50,000 tons in a pile 78 feet high and 310 feet in diameter, whereas the horizontal portion of the reloader is 300 feet in length. This plan of storing fuel is also adapted to use under cover in regions where heavy snowfall makes necessary the housing of all stored coal. For instance, the Lehigh Valley Coal Company has at West Superior, Wis., a plant which provides storage for 100,000 tons of anthracite coal in two circular steel buildings each 246 feet in diameter and 90 feet in height.

THE SPENCER AIRSHIP AND ITS THIRTY-MILE TRIP.

BY WILLIAM EDWARD WARD.

On September 19 London was surprised to see an airship hovering over its chimneys and spires. The air was apparently quite calm, and the ship steadily headed to the northwest, traveling about eight miles an hour. Months ago Londoners heard in a vague way, that an English-built airship was in existence, but the matter excited little interest at the time, and latterly was quite forgotten.

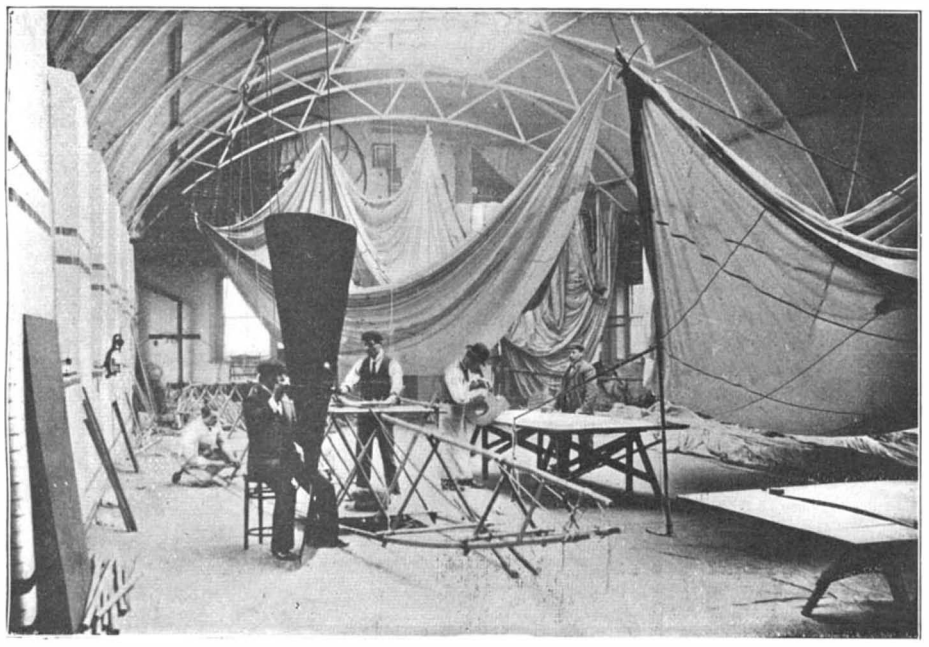
The new airship is the work of Spencer Brothers, a firm of aeronauts now in the third generation, built in their own factory. It was sailed by Stanley Spencer, the second of the three brothers. For three months the air-ship has been awaiting trial in its shed in a South London suburb; and on several occasions it has made experimental captive flights. On September 19 the unusual stillness of the air tempted the aeronaut on what proved a successful maiden trip. At the commencement of his journey he circled in a couple of "figure eights" and repeated the maneuver when over the west of London. For the rest he covered about twenty miles in a trifle over two hours, alighting without mishap just before dark.

The balloon follows the torpedo-shaped construction made familiar by Santos-Dumont, but has more blunted ends. Consequently it has not the graceful lines of its French predecessor. The frame, which bears the aeronaut and the machinery, is constructed of bamboo held taut by piano wire. As seen in the air, it bears some resemblance, in its proportions, to a skeleton canoe. Three long strips of bamboo run the length of the frame, and are kept in position by struts bound triangularly, the base of the triangle being horizontal. The frame is slung from the bag by fine ropes. The principal feature of the construction is the position of the propeller, which is placed at the bow of the ship instead of, as is usual, at the stern. The inventor considers that the effect of this innovation will be to enable the ship to hold a more even course.

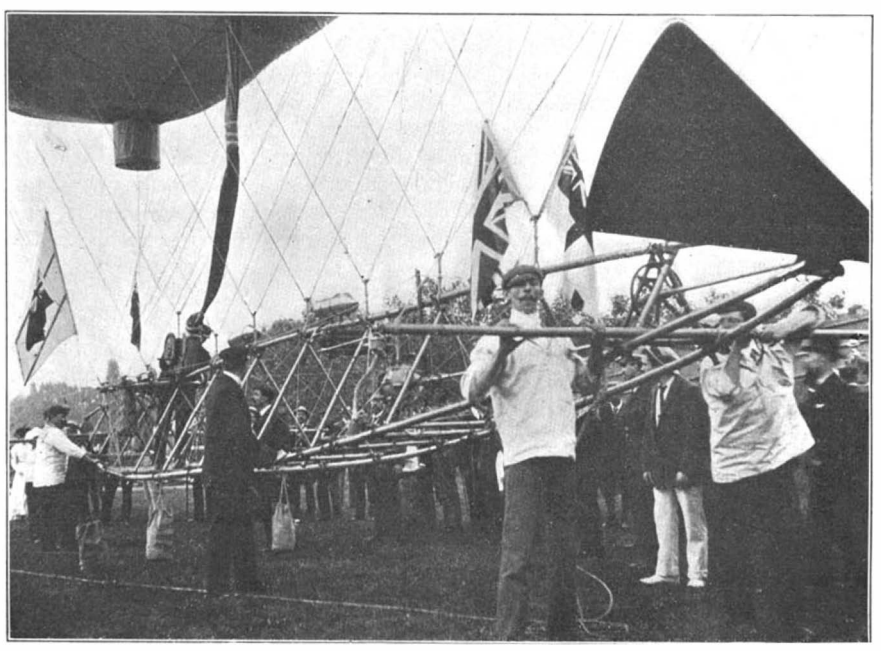
The motive power is supplied by a small petroleum motor swung in the forward end of the frame and firmly bound in position by piano wire. A small cylinder to feed the engine's water jacket is fastened just over the engine. Directly below the engine is the condenser. The fuel tank is fixed to the upper bamboo, but further aft to shield it from the motor flames. A thin rod of steel—the engine's shaft—runs forward to a gear wheel, the axis of which is the propeller shaft.

Toward the stern of the balloon is the aeronaut's stand, inclosed in netting. Behind him is the rudder, a large quadrilateral sail suspended by ropes between the ends of the balloon and the frame. The construction places all the mechanism—except the rudder—directly in front of the navigator, an obvious advantage in cases of sudden emergency.

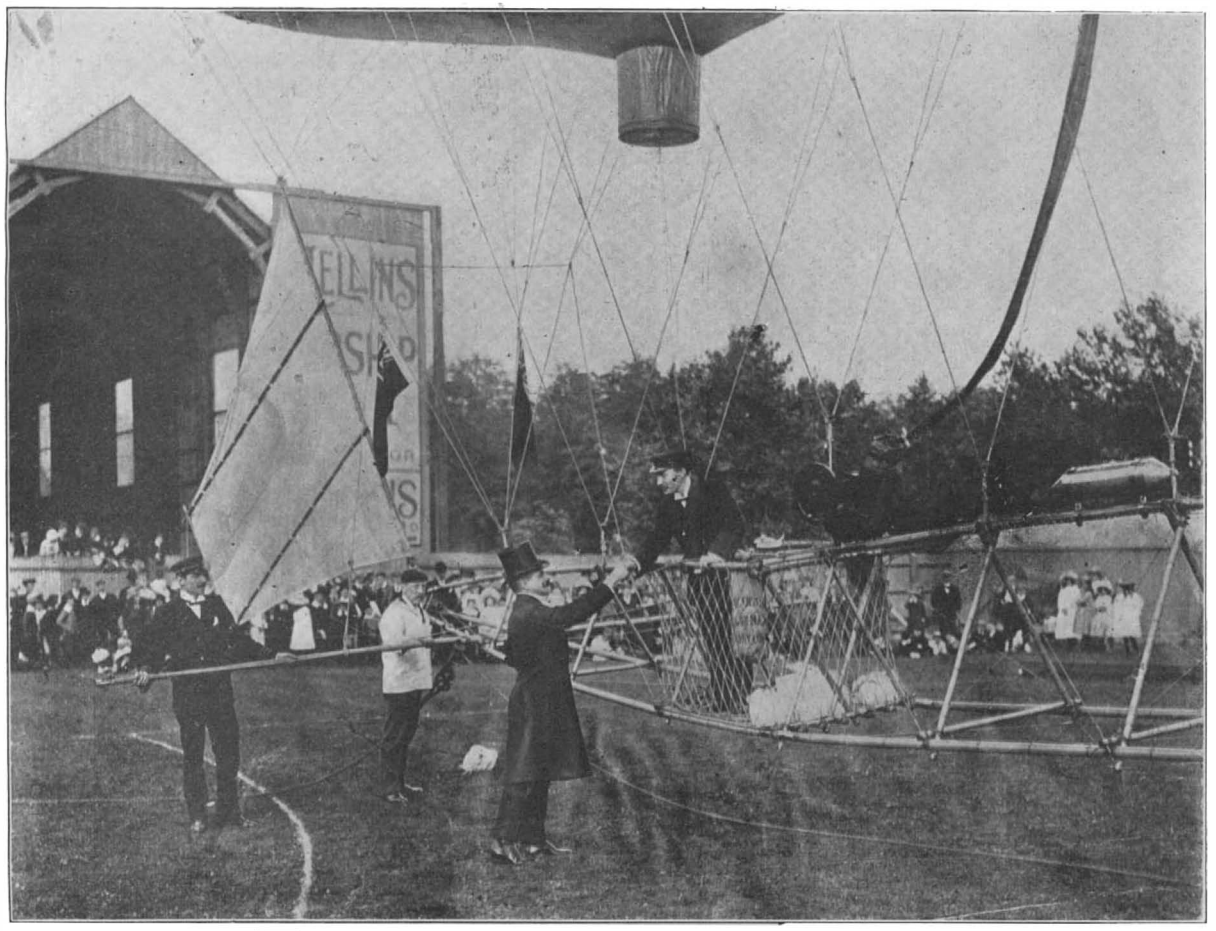
All the working parts are under absolute control from the car. Two cords guide the rudder. The pro-



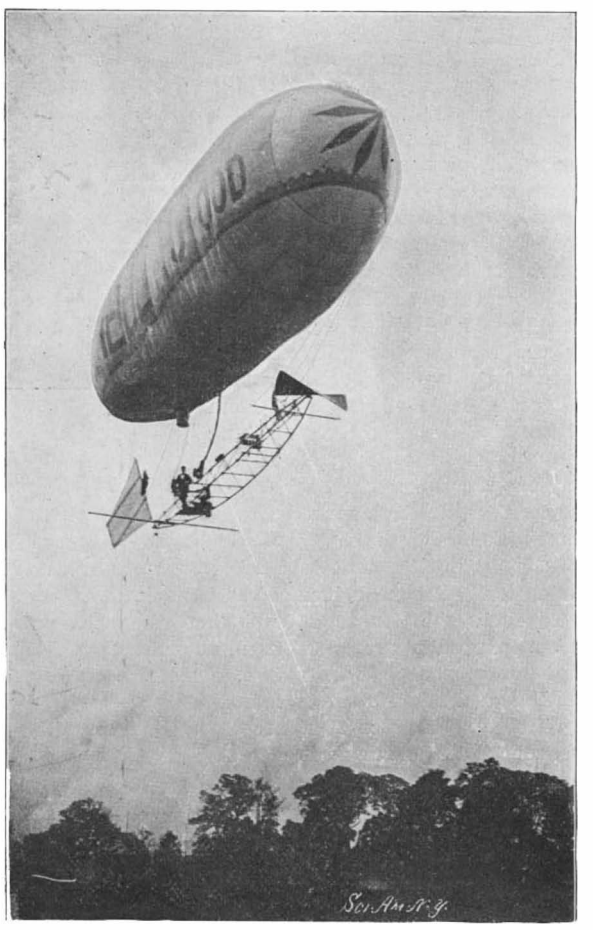
Building Spencer's Airship.



The Car Seen from the Front. Photographed Before the Start.



Spencer Starting on His Trip. The Aeronaut is Shaking Hands with Lachambre, Builder of the Santos-Dumont Ships.



The Ascent from the Grounds at Crystal Palace, London.

THE THIRTY MILE AIRSHIP FLIGHT OF STANLEY SPENCER.

© 1902 SCIENTIFIC AMERICAN, INC.

peller is started or stopped by a friction clutch, operated by a lever; another lever controls the speed of the engine; and an electric switch regulates the ignition devices.

The envelope is of English silk, heavily varnished, and when inflated is 75 feet long. Its capacity is 20,000 cubic feet. The safety valve is placed directly over the car and may be opened by a cord. It is, however, constructed to work automatically; it worked successfully on the trial trip. Sand ballast is carried on the aeronaut's stand; and to decrease the buoyancy of the balloon, air may be forced into it by a small hand blower placed just in front of the stand.

The weight, with netting and gear for supporting the keel, or *nacelle*, is 290 pounds. The keel, or *nacelle*, which in outline approaches that of a well-formed tipcat, is made entirely in skeleton of bamboo, trussed triangularly, and rigidly stayed throughout with steel wire stays. When suspended it is carried 10 feet below the bag. The motor, which is carried on the forward half of the keel, being placed 20 feet from the escape valve.

The engine—a 6.8 horse power Simms petrol motor, with Simms-Bosch ignition—serves to drive the propeller.

The propeller itself is the design of Sir Hiram Maxim, who is an enthusiastic follower of aeronautics. It is double-bladed, built of thin strips of carefully selected pine, weighs 28 pounds, is nearly nine feet long over all, and a full four feet at its broadest part.

The drive is communicated to the screw from the engine shaft by means of doubly universally-jointed propeller shaft, steadied in its center by an adjustable ball bearing slung by four wires from the angles of the keel frame. The engine shaft carries a steel pinion, which meshes with a gun-metal spur wheel ten times the diameter of the pinion, this spur wheel being carried on a shaft attached to the rearward universal joint of the propeller shaft. Thus the propeller revolves at one-tenth of the speed of the engine shaft, the normal rate of which is 1,500 revolutions per minute. The usual coned friction clutch forms part of the engine flywheel, and a free-wheel clutch with starting band is also fitted to the engine shaft. Cords from the clutch and starting clutch mechanism are led back to the aeronaut's car, which consists of a platform on bamboo supports situated in the center of the rear half of the keel. The engine can therefore be started and disconnected from the propeller shaft, and by similar means the sparking is advanced or retarded by the aeronaut at will. At the stern of the keel is placed the rudder, with lines to the car, from which also depends the balancing trail rope. Just forward of the car, on the top of the keel frame, is placed a blower, connected by silken pipe with the interior of the gas bag, and which can be operated by the aeronaut when it is necessary to control the distension and equilibrium of the balloon.

To avoid the danger of explosion when the valve is opened and hydrogen emitted, the motor's exhaust pipe is incased in wire gauze, somewhat after the fashion of a miner's safety lamp.

With a capacity of 20,000 feet, the Spencer airship is about three-quarters the size of the Santos-Dumont No. 6. When fully inflated with hydrogen (at a cost of $250) it has a gross lifting power of 1,000 pounds. The envelope weighs 360 pounds, and the car with all the machinery weighs 300 pounds. This leaves a margin of 340 pounds to be divided between the aeronaut and the net lifting power.

I saw Mr. Spencer almost immediately after his trip, and found him enthusiastic that the construction of his ship was on right lines. He has commenced building a much larger one, of which the only particulars as yet obtainable are that it will carry four or five persons, and will embody all the principles of his No. 1.

London, England.

A Communication from Leo Stevens.

The Editor of this journal has received from Leo Stevens a brief account of his recent ascent at Manhattan Beach, which was commented upon in the Scientific American. Mr. Stevens assures us that the Santos-Dumont balloon steered by Mr. Boyce traveled directly northeast and landed about a mile and a half from the starting point. Mr. Stevens states that he was traveling above this ship on the same line, that when reaching Sheepshead Bay he turned two complete circles and that he then ventured on the trail of the Santos-Dumont. After Mr. Boyce had pulled his emergency cord Mr. Stevens states that he started on his way back against the wind, and that when directly over the Brighton Beach race track, he turned again, sailing directly to Coney Island. On his way back to Manhattan Beach he lost his sparking plug and had to descend in a network of wire. Mr. Stevens claims that the actual distance which he covered was about seven miles.

Mining Water for Coal.

The straits to which New York city has been put by reason of the coal strike have given birth to a most curious occupation. When coal began selling at $10 a ton a Bridgeport wrecking company decided that it was about time to begin the work of mining Long Island Sound. According to the New York Tribune, the method of water mining is quite simple.

The wreck of a coal barge is first located by means of the Lake submarine boat, described some time ago in the columns of the Scientific American. Two boats—"wreck-finders" as they are called—are run out to the territory where the coal wrecks are supposed to be. In each boat about a mile of inch rope is contained. As the boats run alongside each other the ends of the ropes of each boat are spliced, making a continuous rope two miles long, and thereby lashing the two boats together. The wreck-finders then travel in opposite directions for about half a mile and thereupon run parallel to each other. The rope is paid out through a ring in the end of an iron pole projecting over the stern. After sufficient rope has been reeled off, two 300-pound weights are run down the rope from the sterns of each boat. Rapidly sinking to the bottom, these weights hold the rope a short distance from the ground, so that it forms a sweep half a mile long and is bound to catch anything that may come in its way. When the sweep rope catches the boats are stopped, the drums reversed and the rope wound up. The boats travel toward each other until they are almost over the point where the sweep rope is caught. A sounding is taken, and the lead carefully examined for traces of coal. Sometimes the lead tells nothing. A harpoon is then sent down the rope. If it sticks there is probably wood to be found far down in the water. If the harpoon is pulled up with its end blunted, iron or rock may be expected. A diver is now sent down to explore the find. He estimates the quantity and quality of the coal discovered, and decides whether it should be taken out by buckets or by suction pump. Sometimes the diver fastens a floating buoy to the wreck, and the sweep boats proceed on their way, looking for more coal cargoes that have sunk.

Now comes the turn of the lighters. By means of derricks or suction pumps the coal is raised to the surface. Not infrequently a coal wreck is found where the lighter can be pumped full of coal in half a day. Indeed, a wreck that will not fill the hold of the lighter in a day is not considered much of a find. A hundred tons of coal recovered in this way is deemed a fair day's work. When it is considered that a number of coal barges are sunk during every heavy storm on Long Island Sound, it will be readily seen that the business is profitable even in times when there is no coal famine.

The island of Guam was recently visited by many earthquakes. Some of the shocks were violent; indeed, so violent that the government buildings have been badly damaged. A tidal wave destroyed a large part of the crops and caused much suffering among the islanders. Commander Seaton Schroeder has telegraphed that the total damage amounted to $45,000 to government property.

Taking the Hurdles Between the Lions and Tigers.

THE SCIENTIFIC TRAINING OF WILD ANIMALS.

THE SCIENTIFIC TRAINING OF WILD ANIMALS.

BY HAROLD J. SHEPSTONE.

There is no disputing the fact that the training of wild beasts has developed into a science, and no man has given the subject such serious consideration as Mr. Carl Hagenbeck, the world-famous animal dealer, of Hamburg. When in that city recently I called at his interesting animal emporium, for it is nothing else, and sought to discover the methods adopted at this unique training establishment.

At the time of my visit a group of twelve seals were undergoing stage tuition in a large cage, in the open ground, while in another a tiger was being taught to ride an elephant. The seals were being taught their tricks by an Englishman, and I was assured that they had made excellent progress during the seven months they had been under instruction. One of the larger ones, which the trainer affectionately patted on the head every now and again, could already take a small ball in his mouth, bounce it on the floor, catch it on his nose, and waddle with it, balanced in the air, onto his perch. In the other cage, which was under cover, the tiger displayed no small amount of intelligence, and seemed to perfectly understand what was wanted of him. If anything, the elephant was the more nervous of the two.

During the last thirty years Mr. Hagenbeck told me he had trained over seven hundred large animals; such as lions, tigers, bears and elephants, while most of the lion-tamers of Europe and America have passed through his hands. His methods are unique; he believes in individual training, and to him a new lion is a beast endowed with distinct characteristics, and therefore demands separate study and attention. "Like everything else," said Mr. Hagenbeck, "the business of animal training has considerably advanced during the last quarter of a century; and whereas it was considered wonderful for an animal, say a lion, to perform certain tricks, it is now almost essential for the would-be trainer to go through a series of evolutions with quite a number of different animals. It is not difficult to see that to train one animal is an entirely different matter from training a group of say twenty different beasts. I was the first to conceive the idea of training various animals to perform together.

"The first group of various wild animals which I succeeded in training to perform in the arena together, after many weary months, was exhibited at the Crystal Palace, London, in 1891. Their performances caused a sensation at the time, and thousands came daily to see them. After a few months the animals became very sick, so I took them back to Hamburg. Within six weeks after my return they all died. I found it extremely difficult to get good meat on which to feed them while in London. Such animals as lions and tigers like meat soon after the bullock or sheep is slaughtered. It was a great loss to me, for they had not been exhibited long before two American gentlemen offered me $50,000 for the group. I soon got another group ready, however, which I took over to Chicago, to the World's Fair, and they proved a great success.

"I have been busy lately making very extensive arrangements for exhibiting my trained animals in America. I have already sent one group over consisting of sixteen various animals, while by the middle of September another consignment will leave Hamburg for New York, containing a sufficient number of trained beasts to make up three distinct groups. These will travel all over the United States, performing at all the principal cities, and I am sure they will excite no little interest." They will be managed by a concern known as the Hagenbeck Trained Animal Company, an organization composed of four gentlemen, including Mr. Hagenbeck.

The most interesting of these groups, probably, is that made up of two large Nubian lions, one large cross-breed of a lion and a tiger—an entirely new and decidedly interesting beast, of which more anon—three Bengal tigers, two large Indian leopards, two South American pumas, two large polar bears, and four boarhounds. Incredible as it may sound, Mr. Hagenbeck assured me that it took four years to train this one set of animals. Although the group is made up of only sixteen beasts, over sixty were purchased and partially trained before the desired number was obtained. The others were useless from a performing point of view. This is where Mr. Hagenbeck scores over his competitors. Being a dealer in wild animals, as well as a trainer, those beasts that are unfit for the stage are sold to zoological gardens and menageries.

© 1902 SCIENTIFIC AMERICAN, INC.

A wild adult animal is of no use whatever to the trainer, but a young forest-bred beast can be trained as well as those born in captivity. So well are the animals in the group mentioned above trained that they will come out into the arena, one at a time, at the crack of the whip, and take up their positions on the stools or pyramids. According to Mr. Hagenbeck, anyone may become a wild beast trainer, provided he is prepared to give the necessary time, and is endowed with patience, tact, and good judgment. He must have a love for animals and never treat them harshly. The great worry in getting mixed groups together is to get the beasts to agree. If an animal is not liked by its fellows, another one must be secured. Keeping it would only mean continual fighting, and it is often necessary during the early stages of the training to keep men in the cages all night to prevent the beasts from quarreling.

It is interesting here to note that $50,000 has frequently been refused for these groups of trained beasts. Mr. Hagenbeck told me that they often cost him that to get together and train. A tiger, for instance, valued at say $500 would be worth ten times that amount after a couple of years of training. Curiously enough, Mr. Hagenbeck does not look to receive a large profit from the training side of his business, but rather regards it as a good advertising medium. His principal income is derived from the selling of all kinds of rare and wild animals to public zoos, menageries and private parks. For this purpose he keeps a large stock of animals on hand.

At the time of my visit he had the following animals in his depot: Sixteen lions, eight Bengal tigers, seventeen pumas, black panthers and jaguars, twenty-one bears, hyenas and wolves, eleven elephants, eighteen wild pigs of different sorts, twenty-seven camels, six dromedaries, eight various llamas, six zebras, three wild asses, four Mongolian wild horses, eight American bison-buffalo, eighteen yaks and various antelopes, thirty-three deer of different varieties, nine various wild sheep and goats, twelve ostriches, sixty-one cranes and storks, one hundred and seventy-two swan, geese and ducks, lots of monkeys, reptiles, pheasants, vultures, eagles and different varieties of small animals.

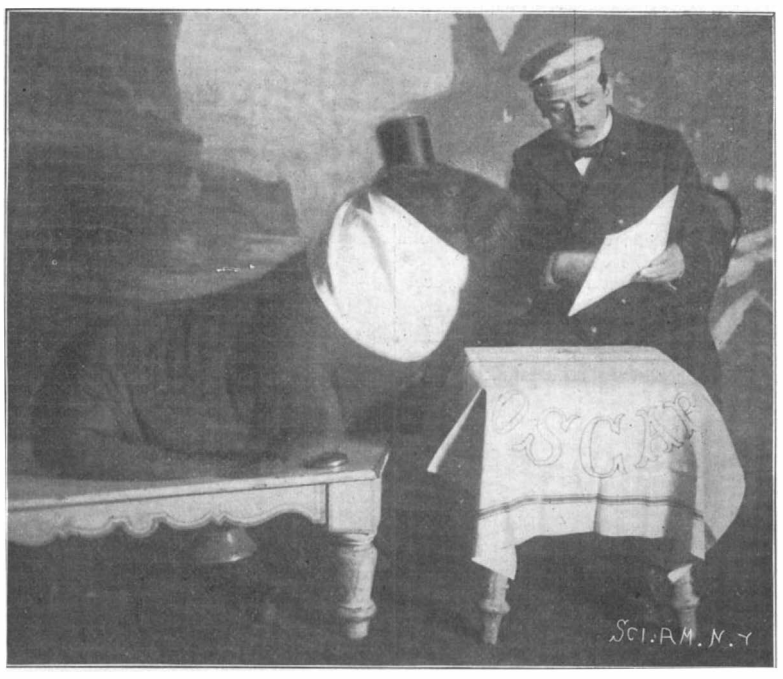
This of course, gives the trainers at Hamburg a varied and large stock to pick from, and explains the reason why no menagerie the world over can hope to turn out such interesting tableaux. All the principal groups of trained wild animals which have been exhibited in Europe, America. India and Australia were first trained in Hamburg. In addition to the three groups in America, there is another performing at Blackpool, England, and another at Nice, on the Riviera. The former is made up of twenty-one animals, between three and four years of age, and the other of sixteen animals.

Mr. Hagenbeck has won considerable fame as an animal importer, and now claims the distinction of being the largest dealer in wild animals and curious beasts in the world. He has made some decided hits at different times in securing specimens of the rarer animals. Thirty years ago he obtained an African rhinoceros for the London Zoological Society, which was the first rhinoceros seen in Europe since the days of the Roman Amphitheater. Seven years ago he imported a Siberian tiger, and four years ago a Persian tiger. Four years ago, too, he landed in Hamburg two lions from Balkash Lake, in Central Siberia, and a couple of tigers from Russia Turkestan. These beasts created quite a sensation in zoological circles, as they were the first species of their kind ever seen in Europe. Last October his depot was enriched by a stud of twenty-eight wild horses from Mongolia. They were caught, as foals, in a district some twelve days' march beyond Pekin, and after much trouble shipped to Hamburg, at a cost, all told, of over $25,000. They were quickly snatched up by the leading zoos, many of them being sold at $2,500 apiece.

A Group Trained After Eighteen Months of Teaching.

Mr. Hagenbeck has conducted some interesting experiments recently in the cross-breeding of animals. Mention was made above of a cross-breed of a lion and a tiger. The peculiarity of this beast is that it has a tiger's body and a lion's head. It weighs nearly five hundredweight, and measures ten feet from the tip of his tail to the tip of his nose, and stands about four feet high up to the top of his shoulder. There are five other similar animals at Hamburg. Mr. Hagenbeck has also crossed zebras with horses, at the advice of Prof. Hewitt, of Edinburgh, Scotland. He recently helped the Duke of Bedford to cross Persian fallow deer with ordinary European deer, so that a bigger and stronger deer could be obtained. The whole idea of this crossing, of course, is to secure a better blood and a stronger breed. In this way he has secured a better breed of pheasants, by crossing pheasants from Central Asia with the European variety. They are larger and heavier birds, stronger on the wing and prettily marked. In conclusion I would add that the great dealer is now busy building a zoo at Stellingen, a suburb of Hamburg, which, when completed, will be the most singular garden of its kind. It will be unique in the manner in which it is laid out. It is to be opened next May.

London, England.



A Trained Walrus.

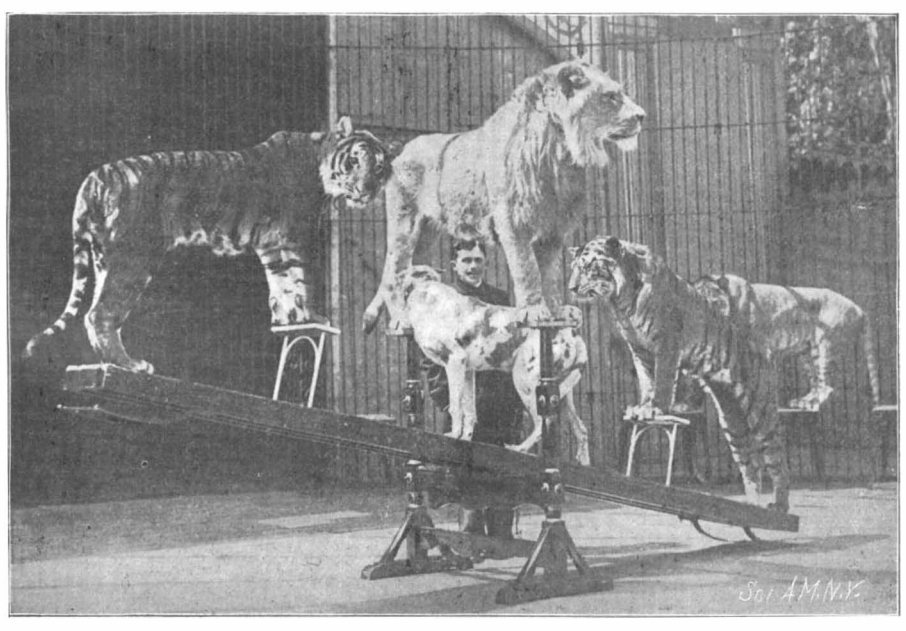
Dr. Woodbury's Collection of Metropolitan Bacteria.

It will be remembered that a few weeks ago the SCIENTIFIC AMERICAN called attention to the fact that Dr. Woodbury, Commissioner of Street Cleaning of New York city, had determined to carry out a series of experiments for the purpose of ascertaining the bacteriological condition of the air of New York city. The first results of the experiments have been given to the public. To one who is not a bacteriologist, the conditions which have been found to prevail are startling.

At various points, selected to give strong contrasts, gelatine-coated plates were exposed for one-half hour at curb level and six feet above the curb. The microorganisms thus collected were transferred to the usual culture medium and allowed to propagate. Exactly what the germ colonies contain has not been definitely ascertained; that they carry enormous numbers of disease germs goes without saying. But it has at least been established that the air near the curb level is much more heavily laden with what is grimly called "rich bacterial flora" than that six feet or more above the sidewalk. It is therefore evident that unclean streets are most unsafe playgrounds for children.

For those who consider municipal cleanliness rather more costly than the end attained would seem to warrant, we recommend the useful object lesson that a plate exposed for one-half hour in clean, residential streets with well-swept asphalt pavements shows five isolated pinhead colonies after an enlargement of 700 diameters; while one exposed for the same length of time under precisely the same conditions of hour and weather, in an East Side street flanked with crowded tenements—from the windows of which tons of refuse are daily thrown—shows nearly 10,000 colonies, some as large as a thumbnail.

A more striking argument in favor of clean streets could hardly be found.



On the See-Saw.

Dinner Time at the Training Quarters.

THE SCIENTIFIC TRAINING OF WILD ANIMALS.

© 1902 SCIENTIFIC AMERICAN, INC.

RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

MOWING-MACHINE.—B. C. WHITE and T. J. JONES, Catlin, Ill. In mowing machines there is always a tendency of the knives to become clogged, whereby the machine is with difficulty started from a position of rest and whereby the knives do not at first act with proper efficiency. The purpose of this invention is to overcome these difficulties, the motive power being first applied to starting the sickle, thereby unclogging the cutting mechanism, so that when power is applied in the usual way, the machine will move forward easily.

Electrical Devices.

ELECTRICAL TYPEWRITER. — CHARLES GIBBS, New York, N. Y. Mr. Gibbs is the inventor of a typewriter operated by electricity. The machine is neat, compact and simple in construction, having nearly all its parts relating to electricity so disposed as to be readily accessible. A revolving cylinder is provided on which a series of buttons are located which correspond to the characters. In operation the desired buttons are depressed and as the revolving cylinder brings the same into contact with a series of brushes the proper characters are printed on the sheet.

ELECTRICAL SYSTEM OF RECORDING AND CHECKING AS APPLIED TO RAILWAY SIGNALING.—W. H. M. WEAVER, Macon, Ga. This electrical recording and checking apparatus operates as a check upon the operator in the manipulation of his railroad signal apparatus and also upon the dispatcher. The act of reversing a semaphore-arm sets in operation an electrical device by means of which a telegraphic sign is transmitted to the central office and duly registered by means of the dispatcher's telegraphic instrument and also by means of a time recorder.

SELECTIVE CALL FOR TELEGRAPH OR TELEPHONE LINE.—W. PALMER, JR., Rincon, New Mexico. The object of this invention is to enable an operator or train dispatcher on a telegraph line to cause an alarm bell to ring at any one or more of the distant stations without ringing the bells at the other stations, and to enable a subscriber or the central office of a telephone line to accomplish the same results under similar conditions.

Engineering Improvements.

ROTARY ENGINE.—W. F. EVANS, Chicago, Ill. Mr. Evans is the inventor of an improved rotary engine of simple and durable construction which is very effective in operation, easily reversible, and arranged to utilize the motive agent to the fullest advantage.

Machines and Mechanical Devices.

VENEER-BENDING MACHINE.—E. ABER, Jacksonville, Texas. This machine is designed to bend portions of veneer with a comparatively slow movement, subsequent to sizing or moistening the work and while it is in engagement with a heated form, thus giving the veneer an opportunity to become thoroughly heated while being bent and making it practicable to bend the stock sharply and thick enough to make baskets for heavy use.

INDICATOR FOR SAWMILL-KNEES.—J. D. BEATTY, Klondike, N. C. The invention relates to indicators used for sawmill knees for showing the position of the log to be sawed, so that the thickness of lumber to be cut away may be readily ascertained and that the width of the log may be exhibited in units of boards of different thickness.

SPIRAL CONVEYER.—C. G. WILLIAMS, Dalton, Iowa. The invention relates to spiral conveyors for moving grain or other material, and it provides certain improvements whereby several sections of the spiral shaft can be readily and securely fastened together and any one section requiring repairs may be readily removed at any time without disturbing the other sections..

KRAUT-CUTTER.—G. H. KINKADE and L. MAGER, Hardin, Ill. An improvement in kraut-cutters is hereby provided whereby cabbage may rapidly and easily be cut into thin strings or kraut. A simple and effective device is afforded by the invention, which is composed of few parts not likely to get out of order and adapted to be readily repaired.

BALANCING DEVICE FOR TURBINE GATES.—W. W. TYLER, York, Pa. Mr. Tyler hereby provides certain new and useful improvements in balancing devices for turbine-gates whereby the gate is completely balanced at any stage of its opening so that the pressure of the water neither tends to open or close the gate and hence the latter can be easily opened or closed by an attendant.

FRAME FOR METAL-SHEARING MACHINES.—B. WESSELMANN, 2 Gartenstrasse, Gross Lichterfelde, near Berlin, Germany. The frame consists of two parts, one of which carries the cutter or blade, which during the process of cutting remains stationary, while the other part constitutes what is generally known as the "body" or "trunk" of the frame. By this method of splitting up the shear frame, material advantages are gained both in regard to the use of the shears and in regard to their manufacture.

FILTER.—THEODORE LINKE, New York, N. Y. This filter belongs to the type having a filter-stone mounted to rotate and a cleaner-stone therefor. Mr. Linke provides a simple means for causing the cleaner-stone to follow the reduced diameter of the filter-stone when it wears away and to maintain equal pressure at all times.

INDICATOR.—T. F. MCCULLOUGH, Memphis, Tenn. Mr. McCullough is the inventor of an indicating apparatus for displaying successive numbers or other characters. It is specially adapted for use in barber shops and like places where persons wait for service in their turn, and when so placed it may with advantage be used in connection with a check box, the customers receiving numbered checks from the check box and the number of these checks being subsequently indicated in their successive order by this indicator.

Railway Contrivances.

CAR-MOVER.—H. C. HARRINGTON and W. M. TOWERS, Rome, Ga. Briefly stated the invention involves a peculiar frame to which a lever is pivoted, a novel means for clamping the rail and novel details of construction whereby a leverage may be brought to bear upon a car wheel to move the car.

TRACK-BRAKE.—T. S. BUTLER, Vandergrift, Pa. This brake belongs to that class of car brakes in which the braking device is applied to the rails, thus saving wear on the car-wheels. With this improved construction the brakes may be applied with great force whenever an emergency occurs. The wearing parts may be renewed at slight expense.

Vehicles and Their Accessories.

BICYCLE-FRAME.—R. F. MONAHAN, Buffalo, N. Y. Mr. Monahan provides in this invention novel features of construction for the frame of a bicycle which will render its rear portion measurably resilient and afford necessary strength to the frame. The employment of this improvement will increase the benefits derived from the provision of pneumatic tires, and add to the durability of the bicycle as well as to the ease of the rider in traveling over rough places.

DRIVING MECHANISM FOR BICYCLES.—K. BROOKS, New York, N. Y. The purpose of the invention is to loosely mount the front sprocket on the crank-shaft of a bicycle and drive the sprocket from the crank through a cushioned yet positive connection. This connection is such as will tend to obviate severe shocks to the machine, thus adding to its lifetime and contributing to the comfort of the rider.

BRAKE MECHANISM.—H. W. COOLEY, Lost Valley, Oregon. An improvement in operating-levers and holding devices for wagon-brakes has been devised by Mr. Cooley. The operating mechanism may be manipulated by a person in the vehicle, to firmly set and hold the brake, or it may be operated to set or release the brake by a person riding on a wheel-horse.

BICYCLE SPROCKET AND CRANK.—G. SPENCE, Newport, R. I. The invention relates to an improved sprocket and crank secured thereto, more particularly for use on bicycles. The device is a neat and compact structure which may be cheaply made and is not liable to get out of order. The ball-bearings are centrally disposed and the sprocket is at one side so that it may be connected in the usual manner to the rear sprocket. By this arrangement, although the alignment is upon the side, yet the wear is in the center of the machine.

MOTOR.—C. J. CULLEN, Jersey City, N. J. This motor is more strictly adapted for use in connection with automobiles. The construction is simple and the motor, which is mounted to rotate with the driving axle, comprises a plurality of cylinders, the pistons in diametrically opposite cylinders being so connected with a stationary crank-shaft that there will be practically no dead centers upon the rotation of the motor. A simple form of compensating gear is provided for difference in travel of two traction wheels while turning corners.

Miscellaneous Inventions.

CHECK-PERFORATOR.—MAXWELL KEANE, New York, N. Y. This check perforator provides a means whereby figures may be readily punched into the body of the check so as to protect it against changing the amount of the check. The device comprises a base-plate having a series of perforating teeth and a lid hinged to the plate which will fold flush upon the base-plate and thus cause perforation of the check.

VAULT-LIGHT.—A. DE MAN, New York, N. Y. This vault light is more especially designed for illuminating subways, basements, vaults, and the like, and is arranged to avoid the frequent breaking or chipping of the glass lenses as heretofore employed and to ensure full utilization and distribution of the rays of light to properly illuminate the underground chamber.

ICE-RUN.—H. D. SIMPSON Coxsackie, N. Y. This invention provides an improved ice-run for stowing blocks of ice alternately into adjacent rooms in an ice-house without danger of injuring the blocks. By the use of this invention the rooms may be evenly and properly filled without requiring interruption or stoppage of the elevator carrying the cakes of ice by the main run from the water below.

RADIATOR.—A. EICHHORN, Orange, N. J. This radiator is divided into two divisions so arranged that either may be heated independently at will. It is preferred to have one section of the radiator much larger than the other and in operation to keep the smaller heated continuously and then, if maximum heat is desired, to adjust the parts so that the larger section also may be heated.

FOUNTAIN-COMB.—J. R. HARRISON, Barnwell, S. C. This invention provides an antiseptic fountain-comb especially adapted for the hygienic treatment of the scalp and hair, and for washing the scalp and removing the dandruff while combing the hair. The construction is such that when the teeth are brought in contact with the scalp any hygienic fluid carried by the body of the comb will be automatically discharged at the tip of the comb-teeth and brought into direct contact with the scalp.

PRODUCTION OF PLASTIC ARTICLES.—E. LOTTIER, West Hoboken, N. J. Mr. Lottier hereby provides certain new and useful improvements in the production of plastic articles, such as boot and shoe heels and various other articles heretofore mainly formed of leather and like material. A heel thus formed will be found very durable and may be readily nailed or otherwise fastened in position on the boot or shoe.

COMPUTING-CHART.—L. B. MANLEY Duluth, Minn. This chart is particularly adapted for use in insurance offices, banks, and the like, and provides a simple means whereby the number of days between any two given dates may be quickly ascertained, at the same time indicating the per cent of the annual premium earned by a policy for the said number of days. In addition to this, indices are provided in connection with the device, referring to numbered lines in cancellation tables.

PEN OR PENCIL-HOLDER.—J. S. MCCLUNG, Pueblo, Colo. In public schools it is considered of advantage for the preservation of the health of the scholars to provide each one with a pen and pencil for individual use and to require the rule against indiscriminate use of such instruments to be strictly observed. The object of this invention is to provide a holder for holding a number of pens or pencils separated and clearly distinguished from each other by suitable designating characters, so that each pupil will be enabled to quickly select his individual pen or pencil at the opening exercises and return the same correctly within the holder at the end of the day.

WRENCH.—T. H. CAHILL, Terra Alta, W. Va. In this wrench the movable jaw may be quickly locked in any desired position and can be easily released for adjustment to another position, as is frequently desired in the use of monkey wrenches. The parts are simple in construction, easily operated and not likely to get broken or out of repair.

TORPEDO-SHELL PROTECTOR.—J. M. HATFIELD, Corning, Ohio. The invention is an improvement in devices for use in connection with oil-well torpedoes, being designed to provide a protector applied to the torpedo shaft and to operate as a guide for the same in passing the shell through the casing of the well, whereby to avoid the friction and jars incident to such operation.

BURNER.—J. L. JONES, JR., Dallas, Tex. An improvel burner is hereby provided for use in fireboxes of boilers and other apparatus more especially designed to burn crude oil. The burner is arranged to develop a constant flame for producing a high heat in the fire-box, at the same time insuring complete combustion without the production of smoke and obnoxious unburned gases.

SHEET-METAL PIPE.—F. L. FILSON, Point Pleasant, W. Va. Mr. Filson provides a simple means for securing the edges of stove-pipes together, so that accidental separation of one joint from another will be practically impossible. The pipe is what is termed as "nested" pipe, because, for convenience in transportation, the edges of the sections or joints are to be left open, so that several joints may be placed one within another.

BOOM RIGGING.—F. V. NIELSEN, San Francisco, Cal. Ordinarily booms swing at their inner ends against the mast and iron or other metal sheets are secured on the masts to take the wear. Water getting beneath these plates rots the masts and in endeavoring to avoid this injury Mr. Nielsen provides an improved construction which will efficiently support the boom and permit the movements thereof in various directions required.

KNOCKED-DOWN BANANA-SHIPPING CRATE.—J. CONRAD, Chicago, Ill. The invention provides for the compact disposition of the parts comprising the crate in shipping the same back to the owner, thus effecting economy in transportation charges and enabling a large number of crates to be stored in a car or other place. The crate is designed to be quickly and easily expanded for service, and will not collapse when loaded.

STRIP FOR SECURING GLASS PANES.—J. SWANNELL, Red Bank, N. J. Mr Swannell is the inventor of an improved means for securing glass panes and analogous objects in position, more particularly in windows and similar structures. The construction of the strip is such that it may be conveniently used for any thickness of glass.

MIRROR-HANGING.—J. G. ALLEN, Ubly, Mich. The invention relates to improvements in devices for hanging and supporting mirrors and it aims to provide a simple means for holding in a main frame a mirror at any desired angle. Another object is to provide in connection with the main frame devices for holding various articles.

DESIGN FOR SHADE-CLOTH. — J. H. WRIGHT, New York, N. Y. The design consists of serpentine open-work scroll-figures extending over a mosaic background and irregular lines of circular figures between the said serpentine figures.

PENCIL AND SHARPENER THEREFOR.—R. Y. CORMACK, Jamaica, N. Y. Certain new and useful improvements are provided in this invention for pencils and pencil-sharpeners, whereby the sharpener forms a fixture of the pencil to permit the user to quickly and conveniently sharpen the pencil and allow convenient adjustment of the sharpener on the pencil as the latter wears away.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 3252.—For machines for braiding straw for making hats.

AUTOS.—Duryea Power Co., Reading, Pa.

Inquiry No. 3253.—For mechanical massage machines.

For logging engines. J. S. Mundy, Newark, N. J.

Inquiry No. 3254.—For makers of astronomical telescopes.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 3255.—For the makers of the "1900 Oil Gas Burner."

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 3256.—For manufacturers of glass pens.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 3257.—For dealers in second-hand transit and surveying instruments.

Die work, experimental work and novelties manufactured. American Hardware Mfg. Co., Ottawa, Ill.

Inquiry No. 3258.—For manufacturers of clock dials.

Gear Cutting of every description accurately done. The Garvin Machine Co., 149 Varick, cor. Spring Sts., N.Y.

Inquiry No. 3259.—For makers of cast iron pipe.

Manufacturers of patent articles, dies, stamping tools, light machinery. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 3260.—For makers of automatic packeting machines.

The largest manufacturer in the world of merry-go-rounds, shooting galleries and hand organs. For prices and terms write to C. W. Parker, Abilene, Kan.

Inquiry No. 3261.—For makers of labor-saving bricklaying machines.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engines built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 3262.—For manufacturers of bag-making machinery.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $5. Munn & Co., publishers, 361 Broadway, N. Y.

Inquiry No. 3263.—For information as to the Poulsen's telegraphone.

FOR SALE.—A number of finished and unfinished Tonneau, Surrey and Stanhope automobile bodies at a sacrifice. Inspect at former factory, Automobile Co. of America, Marion, Jersey City, N. J.

Inquiry No. 3264.—For parties to manufacture twisted wire goods.

☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Inquiry No. 3265.—For a small engine for a light, open boat.

Inquiry No. 3266.—For makers of gasoline motors for bicycles.

Inquiry No. 3267.—For manufacturers of kerosene marine engines.

Inquiry No. 3268.—For makers of mail order novelties, such as fountain pens, rubber balls, etc.

Inquiry No. 3269.— For makers of drawing presses.

Inquiry No. 3270.—For manufacturers of fruit basket machines. also machines for rolling sheet metal.

Inquiry No. 3271.—For makers of hard rubber goods.

Inquiry No. 3272.—For machines for making waste, such as are used by engineers, machinists, etc.

Inquiry No. 3273.—For a power plant including 4 boilers of 150 h. p. each, 2 engines 250 h. p. each, 2 dynamos same capacity, pumps, heaters, etc.

Inquiry No. 3274.—For kerosene burners for steam heating plants in schools.

Inquiry No. 3275.—For makers of smoke consumers.

Inquiry No. 3276.—For fire alarms for large buildings.

Inquiry No. 3277.—For makers of spring motors.

Inquiry No. 3278.—For makers of automobile and gasoline engine castings.

Inquiry No. 3279.—For a machine for emb photograph mountings.

© 1902 SCIENTIFIC AMERICAN, INC.

INDEX OF INVENTIONS

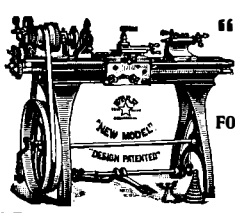
For which Letters Patent of the United States were Issued for the Week Ending October 7, 1902,

AND EACH BEARING THAT DATE.

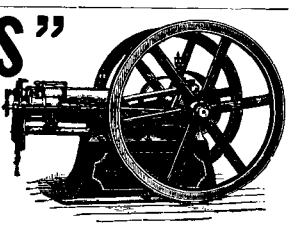
[See note at end of list about copies of these patents.]

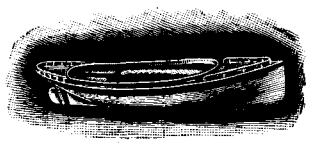
Absorbent preparations, making mineral, A. G. Saunders 710,521
Acetyl chlorid, making, A. Wohl..... 710,648
Adjustable frame for holding articles, M. Norden 710,797
Advertising device, E. Steinhauser 710,814
Air brake systems, automatic safety lock for, W. H. Sauvage 710,522
Air compressor regulator, W. Prellwitz.. 710,712
Air reservoir, compressed, T. D., J. C. & H. A. Prescott 710,889
Alarm: See Burglar alarm.
Alcoholic liquid purifier, C. C. Clark..... 710,669
Alkalies, production of the metals of the, Moeser & Eidmann 710,493
Ammunition, magazine for fixed, E. Muller 710,706
Anchor, J. P. S. Lawrance..... 710,918
Anchor, ship's, J. Verity 710,825
Attaching device, E. L. Hobart 710,776
Automobile safety stop, C. A. Ott..... 710,508
Axle, W. C. Simons 710,529
Axle center, C. T. McCue 710,921
Axle lubricator, car, J. R. Fleming..... 710,677
Axle, vehicle, Cornett & Walker 710,431
Badge, E. B. Wilmarth..... 710,828
Ball and socket fastening, U. E. Dice.... 710,439
Band cutter and feeder knife, F. J. Wood 710,649
Bathing tub for dipolar galvanic baths, J. Zwiebel 710,933
Bearing, anti-friction, C. A. Latham..... 710,785
Bearing hangers, drop-forged box for roller, C. J. Marbach 710,487
Bearing lubricator, car axle, L. L. Logan 710,481
Bed coupling, E. M. Antisdel..... 710,733
Bed spring stretching apparatus, P. J. Waters 710,545
Bedstead mattress support, J. Koch 710,697
Bedstead valance hanger, I. M. Littell.... 710,477
Beer drawing apparatus, C. A. Bartliff.... 710,739
Beet topping machine, E. Heyde 710,578
Bicycle canopy support, G. Valiant..... 710,726
Bicycle lock, J. G. Hann..... 710,576
Bicycle motor, R. S. Anderson..... 710,831
Binder, temporary loose leaf, J. F. Cordes 710,763
Blow testing machine, H. S. Mills. 710,704, 710,705
Blower, forge, W. Roach 710,614
Boats, etc., apparatus for raising or lowering canal, A. Umlauf 710,635
Boiler, B. R. Hoisington..... 710,579
Boiler cleaner, J. W. Cone..... 710,843
Bolster spring, E. B. & C. E. Adams.... 710,398
Boring and tenoning machine, A. A. Koch.. 710,871
Boring implement, J. Lund..... 710,700
Bottle carrier, O. F. Clark..... 710,563
Bottle for medicine, etc., C. W. McShane 710,708
Bottle, milk testing, O. Anderson 710,553
Bottle, non-refillable, F. A. Lucas..... 710,875
Bottle, non-refillable, J. R. Latham..... 710,917
Bottle washing machine, R. Birkholz.... 710,742
Box, A. F. Mack 710,789
Brake, Wellman & McGeorge 710,640
Brake shoe, E. J. Snow..... 710,530
Breweries, system of ventilating the fermenting rooms of, L. Michel..... 710,791
Brick kiln, L. Blackman 710,415
Brick or block pressing apparatus, Blizzard & Todd 710,743
Broiler, etc., E. A. Leland..... 710,786
Bucket or parcel carrier, E. V. Hutchens.. 710,780
Bucket supporter, W. H. Thompson 710,907
Buckle, P. E. Wiberg..... 710,641
Building construction, W. F. Giles..... 710,679
Bung and bung attachment, T. Tietz..... 710,631
Burglar alarm, R. A. Brachvogel..... 710,746
Burial apparatus, automatic releasing device for, W. L. Barth 710,406
Burner: See Gas burner.
Butter mold, F. A. Wegner 710,546
Calculating machine, H. E. Goldberg..... 710,772
Can heading machine, W. Rubin 710,895
Candle molding machine, C. Rubsam..... 710,806
Car body bolsters, construction of railway, C. Vanderbilt 710,636
Car draft and buffing mechanism, W. Wright 710,929
Car hand strap, railway, M. Straus..... 710,535
Car hand strap, street, M. Straus..... 710,536
Car loader, box, Smith & Harp..... 710,902
Car mover, R. Miller 710,491
Car, pleasure railway, H. Funk 710,447
Car, railway or other, Maurer & Furtner. 710,591
Car replacer, O. W. Johnson 710,584
Car roller side bearing, F. K. Fassett..... 710,673
Car sander, railway, D. N. Miller..... 710,489
Car side bearing, W. A. Pungs..... 710,609
Car side bearing, railway, C. H. Williams, Jr. 710,645
Car vestibules, etc., diaphragm for, H. H. Schroyer 710,924
Car wheel flange lubricator, G. W. Newton 710,709
Cars, automatic safety device for, W. H. Caley 710,423
Cars, flexible piping for the air, steam, or other piping for railway, G. Riexinger. 710,514
Carbureter, O. W. Williams..... 710,646
Carpenter's bench and vise, combined, G. W. Raynor 710,713
Cart for collecting and removing sweepings, Gull & Muller 710,453
Casing perforator, P. H. Mack..... 710,701
Ceiling rosette for drop lights, C. F. Lewis 710,787
Cement mixing machine, T. W. Connolly. 710,760
Center, temporary, J. O'Neil..... 710,506
Centrifugal extractor, H. A. Peterson..... 710,607
Centrifugal separator, W. B. Smith..... 710,626
Chain wrench, J. J. Seeman..... 710,719
Chair attachment, A. M. Shauck..... 710,526
Cheese cutter, W. G. Doty 710,672
Christmas tree stand, W. Cook 710,762
Churn, E. E. Dail 710,436
Cigar and cigarette holding device, Baumeister & Adler 710,657
Cigar box lid holder, E. C. Young..... 710,549
Cigar cutter, J. H. Bowen 710,663
Cigar cutter and match igniter, A. R. T. Miller 710,792
Clasp or buckle, C. M. Berry..... 710,412
Clock, electric, W. F. Winslow..... 710,829
Clock, electric alarm, A. V. Strait..... 710,927
Cloth clamp for textile machinery, I. F. Peck 710,799
Cloth cutting machine, J. B. Gury 710,683
Clothes line reel, M. H. Kemper 710,585
Clutch, G. E. Medley 710,593
Clutch, friction, L. J. Harris..... 710,685
Clutch mechanism, F. W. Montgomery... 710,494
Coal ramming and transfer apparatus, J. F. Wilcox 710,643
Coaster brake, G. F. Barton 710,556
Coat and hat lock, G. E. Allen..... 710,400
Cock, plug, L. J. Bordo 710,744
Combination chair, C. F. G. Behr..... 710,409
Combination lock, J. W. Gonce..... 710,449
Compound engine, J. H. Wescott..... 710,910
Converter, W. J. Knox 710,589
Converter or furnace lining, W. J. Knox. 710,916
Converters or furnaces, form[illegible] the lining of, W. J. Knox 710,588
Conveyer, automatically [illegible]led, A. Grossmann 710,574
Conveyer, screw, J. A. M[illegible] 710,879
Conveying apparatus, T. S. [illegible] 710,492
Cooker, steam, C. H. Amidon 710,552
Cooler or condenser, J. Schneible 710,810
Cooling apparatus, W. Griesser 710,857
Cord adjuster, D. M. Carr..... [illegible]0,666
Cork and dropper, combined, W. Keu[illegible] ..... [illegible]587
Corn sheller, O. E. Davidson ..... [illegible]48
Corner strip, W. N. McDonald ..... [illegible]
Corpse cooler, S. A. Boucher ..... [illegible]
Cotton gin, roller, C. J. McPherson, reissue
Cotton press, W. H. Mecom ..... 7[illegible]
Coton sweep, J. J. McManmon ..... 710,[illegible]
Counter, word, C. W. Price ..... 710,8[illegible]
Coupling: See Bed coupling.
Coupling device, G. J. Scott 710,524
Coupling pin, spring, E. Dodd..... 710,849
Cover, cooking vessel, J. H. Wilson..... 710,548
Crane, H. O. Baldry 710,555
Cream separator, G. Klay 710,471
Cuff holder, D. G. Armstrong 710,734
Culinary vessel, C. Grothe 710,681
Curtain fixture, C. J. Wiltsie 710,644
Cut-off and strainer, rain water, C. T. Childers 710,668
Cutter, N. Johnson 710,583
Cutting machine, hydraulic, W. J. Bridger 710,837
Damper, automatic stovepipe, Smith & Mathis 710,901
Dead centers, device for overcoming, C. Reeves 710,512
Decoy duck, J. Coudon 710,433
Dental cuspidor, J. E. Van Nostran..... 710,638
Die press, E. W. Silsby 710,621
Diffusion apparatus, C. Steffen 710,533
Display box, folding, A. Bauer..... 710,407
Display rack, curtain, Bebb & Eaton 710,408
Dock, floating dry, A. C. Cunningham.... 710,765
Dough mixing apparatus, L. C. Sharpless 710,619
Draft appliance, C. M. Arnold 710,833
Draft equalizer, W. D. Baxter..... 710,558
Draw bench, H. H. Knight 710,915
Drawer guide, J. Schaad 710,523
Drilling machine, rotary, Davis & Terry.. 710,438
Dust collector, W. W. Sly 710,624
Dust collector or separator, Osborne & Bryant 710,605
Dye and making same, blue sulfur, W. Dollfus 710,766
Dyeing indigo, F. Peterhauser 710,800
Eccentric, C. W. Hollender 710,865
Educational chart and support therefor, R. R. Anderson 710,653
Egg, mite and louse killing nest, Cannon & Arnold 710,665
Elastic material and producing same, A. M. D. Clasen 710,564
Electric body appliance, Collins & Boland 710,429
Electric elevator, R. C. Smith 710,625
Electric generators, controlling device for, J. H. Bickford 710,414
Electric light switch, H. W. Lawrence.. 710,473
Electric machine frame, dynamo, A. J. Churchward 710,425
Electric motor. G. H. Reynolds 710,716
Electric motor or generator, J. A. Titzel, Sr. 710,541
Electric motor starting device, T. M. Pusey 710,892
Electric switch, G. H. Hill 710,455
Electrical conduit bushing, Mauer & Billings 710,488
Elevator, J. D. Ihlder 710,581
Elevator, S. R. Harris 710,686
Elevator gate, automatic, I. S. McNaught 710,601
Elevators by single push button system, electric operation of, J. D. Ihlder..... 710,914
Enameling baths or other metal objects, machine for mechanically, P. Dupont... 710,443
Engine cylinder, gas, H. E. Ebbs 710,911
Engine sparking device, explosive, T. S. Glover 710,771
Engine speed regulator, explosive, L. W. Witry 710,647
Engines, incandescent igniter for explosive, C. W. Weiss 710,824
Envelop and fastening therefor, A. M. Hanan 710,684
Envelop or covering, letter or similar, O. B. & W. H. Peck 710,710
Envelop, safety, A. O. Anderson 710,731
Excavating machine, H. G. Butler 710,664
Expansion bolt, C. H. Steward 710,534
Explosion engine, W. G. Wilson 710,727
Extractor: See Centrifugal extractor.
Eyeglass nose guard, H. Borsch..... 710,419
Eyeglass nose guard, E. B. Meyrowitz.... 710,594
Eyeglass nose piece, H. Borsch..... 710,418
Eyeglasses. E. M. Singleton 710,622
Fan, mechanical, G. Kaiser 710,465
Fare register, A. E. Nielsen 710,796
Farm machines, apparatus for operating, J. M. Dallas 710,846
Fastener, separable, A. Haug 710,863
Feed bag, self-adjusting, Cutler & Smith.. 710,670
Feed cutter, stock, L. L. Mallard..... 710,919
Felt boot, C. E. Seibert 710,925
Felted boots or fabrics, forming bellows folds in, D. A. Shaw et al..... 710,527
Fence, wire, A. G. Hoefer 710,913
Filaments from cellulose solutions, manufacture of, E. Thiele 710,819
File, paper, W. Downie 710,442
File, paper, Z. C. Ketchum 710,586
Filter beds, apparatus for distributing liquids over, W. D. Scott-Moncrief... 710,525
Finishing machine, G. Shutt 710,620
Firearm, T. Bergmann 710,411
Fireproof construction for buildings, P. F. Brandstedt 710,836
Fish splitting and cleaning machine, A. J. Farmer 710,912
Fluid brake mechanism, J. F. Mallinckrodt 710,876
Flume gratings, device for clearing, J. G. Riel 710,804
Fowls, device for extracting tendons from the legs of, F. O. Richmond 710,803
Fruit jar, J. Tcherniac 710,818
Fuel, manufacturing artificial, C. J. Holmes 710,580
Furnace, T. Murphy 710,707
Furnace grate, F. Fiebeger 710,570
Furnace grate bar, G. A. Ellis 710,569
Game apparatus,, H. T. Coldwell 710,565
Garbage receptacle, H. P. Berck 710,835
Garment fastening, A. B. Cushman 710,435
Garment hanger, M. Laidlow 710,698
Garment hanger, M. Gordon 710,773
Garment supporter, F. Ferguson 710,675
Gas burner, incandescent, G. W. Thurnau... 710,540
Gas distributing system, F. C. & G. L. Wilson 710,642
Gas generator, acetylene, Beck & Homan.. 710,559
Gas generator, acetylene, W. J. Loyer.... 710,874
Gas lighter, electric, A. Radiguet..... 710,802
Gate, E. M. Grosnickle..... 710,575
Gear, variable speed, C. M. Manly..... 710,485
Gearing, variable speed, G. E. McElroy.. 710,500
Gold, etc., machine for separating, W. J. Barron 710,738
Gold separator, W. W. M. Hickey..... 710,690
Golf ball, R. B. Cavanagh.....710,750 to 710,755
Governor for power engines, automatic, J. H. Cook 710,761
Governor, speed controlling, H. N. Motsinger 710,597
Grader, pneumatic, Osborne & Bryant..... 710,603
Grain binder, E. A. Johnston..... 710,781
Gun, semi-automatic, Bennett & Johnson.. 710,660
Gun, spring, S. Daniels 710,437
Gunner's ear muffle, W. S. Franklin..... 710,572
Hair crimper, J. F. Martin..... 710,702
Hammer, foot power, E. F. Edgecombe.... 710,567
Hammer, magnetic tack, A. R. Robertson.. 710,615
Handle bolt, A. W. Terrill 710,906
Harness attachment, Petway & Tritschler. 710,885
Harness strap protector, N. W. Pond.... 710,511
Harrow and seed planter, combined, A. C. Palmer 710,883
Harrow plow attachment, side, W. A. Taylor 710,629
Harvester reel, W. Miller 710,878
Harvesting machine reel, folding, F. T. Baker 710,402
Hat forming or shaping die, lady's, M. Quinn 710,610
Hat stand, J. F. Riley 710,805
Hay loader, W. O. Baker 710,403
Heating liquid or gaseous bodies under pressure, apparatus for, A. Prat..... 710,608
Heating system, hot water, J. A. Donnelly. 710,566
Hemming apparatus, garment, L. Newman. 710,503
Hemming machine, garment, L. Newman. 710,504
High chair and go cart, combination, V. Rathknecht 710,923
Hoisting and conveying apparatus for long metal bars, etc., C. H. Morgan..... 710,920
Hoisting machinery, mechanical brake for, Coleman & Hitt 710,757
Hook. See Snap hook.
Hook, J. J. Felder 710,445
Hook and eye, D. S. Daily 710,671
Hook for attaching hose supporters to corsets, Hammond & Taylor 710,862
Hoop driving machine, barrel, W. Burkart. 710,421
Horse detacher, T. P. Rumsey..... 710,520
Horseshoe, F. A. Schleppy..... 710,618
Horseshoe calk, removable, H. A. Kendall.. 710,783
Horseshoe, non-interfering, J. T. Broach.. 710,839
[illegible]se coupling, W. A. Ford..... 710,768
[illegible] coupling, F. P. Dolen..... 710,850
[illegible]carbon burner, S. Berens..... 710,410
[illegible]paratus for the manufacture of plate [illegible]ock, E. Barrath 710,656
[illegible] Block 710,662
Inc[illegible] R. L. Hunter..... 710,779
Inkli[illegible] B. Laughton..... 710,699
Intern[illegible]tion engine, P. F. Maccallum 710,483
Jar holding device and cap turner, G. W. Pagett 710,606
Jigs for washing minerals or ores, actuating mechanism for, C. J. Hodge..... 710,777
Journal bearing, C. H. Keeney..... 710,466
Knitting machine, circular, L. N. D. Williams 710,826
Label affixer, G. E. Howard..... 710,867
Lamp gas cap, arc, E. H. Belden..... 710,659
Lamp, incandescent gas, Frenot & Gimonet. 710,446
Latche attachment, R. M. Russell 710,807
Lathe grinding attachment, R. M. Russell. 710,808
Lawn rake, F. A. Smith 710,900
Lens mount, C. A. Zeiser..... 710,556
Lid controlling device, L. J. Sticklin..... 710,903
Linotype machines, mechanism for pushing the linotypes out of molds of, C. A. Albrecht 710,652
Liquors from kegs, treating air for forcing malt, C. A. Bartliff..... 710,404
Load binder, F. W. Vickers..... 710,639
Loading apparatus, dirt, O. Tiffany..... 710,820
Lock, O. E. Nickey..... 710,505
Lock, J. Hohagen 710,692
Loom, A. S. Horlacher 710,458
Loom picker stick, Wilde & Lee..... 710,827
Loom weft stop motion, G. Fair..... 710,767
Mail bag catcher, Houser & Gorman..... 710,[illegible]
Mail box, P. P. I. Fyfe..... 710,854
Mail service apparatus, rural route, M. S. Hoover 710,457
Marine structures, erecting, E. Becker..... 710,658
Massaging machine, W. W. M. Hickey... 710,689
Match box, E. Altimus 710,551
Measuring receptacle for liquids, etc., J. W. Zimmerman 710,932
Mechanical brake, Coleman & Hitt..... 710,758
Mechanical friction brake, Coleman & Hitt.. 710,739
Metals, hardening, M. J. R. Greenman.... 710,452
Mine turn table, Eppers & Hamilton..... 710,851
Mitering machine, J. Locke 710,479
Modeling and decorating apparatus, M. B. Church 710,842
Mold, O. Nolan 710,881
Money arm band, C. O. Anderson..... 710,732
Morse apparatus, device for automatically unrolling the paper ribbon in, L. Cerebotani 710,607
Motor, W. T. Fox 710,769
Motor controller locking device, G. G. & A. G. Guenther 710,682
Mowers, reapers, etc., cutting apparatus for, A. Stevens 710,816
Mowing machine, A. Stevens 710,815
Neckwear fastener, J. Weil 710,547
Nut lock, F. Moser..... 710,795
Oil burner, E. J. Sharp..... 710,898
Oil burner, C. W. Sievert..... 710,899
Oil burner, crude, J. B. Seeger..... 710,718
Oil feeder, multiple, A. Winton 710,928
Ore treating apparatus, S. T. Muffly 710,495
Ores, treating, S. T. Muffly..... 710,496
Packing box, knockdown, J. F. Reul..... 710,715
Packing machine, I. Lazaga..... 710,474
Pad. See Inking pad.
Padlock, H. A. Smith 710,722
Pail lantern attachment, dinner, Pratt & Polly 710,888
Paper box end flaps, machine for uniting, G. R. Wyman 710,930
Paper cutting machine, N. Gray, Jr..... 710,451
Paper holder, toilet, W. A. Dickinson.... 710,440
Paper making machine mixer, G. L. Hodge. 710,456
Paper receptacle, air tight and moisture proof, L. G. Reynolds..... 710,513
Partitions and means for operating them, flexible, H. S., A. P., & W. F. Miller 710,490
Pen, fountain, C. G. Southmayd 710,724
Pen fountain attachment, J. P. Murdock.. 710,599
Pencil sharpener, R. C. Uecke 710,822
Photographic film spool, H. W. Hales.... 710,774
Photographic fixing bath, A. Eichengrun.. 710,568
Photographic shutter, Sebba & Cohen.... 710,717
Piano attachment, upright, A. A. Van Buren 710,543
Picture, embossed, A. Berninger..... 710,741
Pipe joint, M. F. & C. Stephens..... 710,725
Pipe leak closing device, A. A. Sindelar... 710,721
Pipes, apparatus for turning terra cotta, A. Robinson 710,894
Plane, C. H. Fox 710,678
Plane, bench, J. A. Traut 710,542
Planter, cultivator, and harrow, combined, W. A. Ansley 710,832
Plow, C. E. Bates 710,557
Plow, disk, S. V. Weeks 710,908
Plow pushing device, R. L. Johnson..... 710,464
Pole and neck yoke, safety carriage, M. McNutt 710,501
Post cap, Summerer & Craig 710,538
Press standard, C. Torricellas 710,632
Printing in gold, silver, or other powders, machine for, T. Hooley 710,693
Printing machine, H. A. W. Wood..... 710,650
Printing roller adjusting device, J. S. Bulluck 710,747
Pulp vessels, apparatus for manufacturing closed, F. B. Howard 710,694
Pulverizing and grading material, system for, Osborne & Bryant..... 710,604
Pump, G. E. Green 710,856
Pump controller, beer or other, E. S. Baldwin 710,736
Pump, force, D. L. Friddle 710,770
Pump, oil well, J. Horsley..... 710,778
Pump, quadruple, W. H. Blair..... 710,416
Quicksilver furnace, R. Scott..... 710,897
Rail bond, C. Sprague 710,532
Rail bond, E. P. Morris..... 710,794
Railway permanent way, E. Ruttkowski.. 710,617
Railway switch operating mechanism, street, W. H. Kirkley 710,470
Railways, automatic switch mechanism for street, J. D. Cottrell 710,432
Range finder mounting, Barr & Stroud.... 710,737
Refrigerating apparatus, J. V. Skoglund.... 710,623
Refrigerating rooms, etc., window for, W. Griesser 710,858
Refrigerator car, W. J. Hughes..... 710,695
Refrigerator door, W. Griesser 710,859
Retort closure, Letson & Burpee..... 710,476
Revolver, G. Tresenreuter 710,821
[illegible]ling tray, B. Lenzen 710,475
Rock drill, rock drilling machine bit, etc., D. Mackenzie 710,484
Rock drilling machine, W. Prellwitz..... 710,922
Roll clearer, J. Thomson..... 710,539
Rotary drill, portable pneumatic, J. Keller 710,782
Rotary engine, C. H. Hawkins 710,577
Rotary engine, J. Zura 710,730
Rotary engine, T. S. Colbourne..... 710,756
Rotary expansion engine, R. S. Philips.. 710,711
Rotary motor, Philippon & Chevalier.... 710,510
Rowlock, F. S. Lowe 710,873
Rubber articles, apparatus for placing insertions in, R. A. Stevens 710,817
Rubber hose pipe, tubing, etc., manufacture of, G. E. Heyl-Dia 710,688
Running gear, H. P. Colby 710,428
Safe door, screw, W. E. Arnold..... 710,554
Safe door, day lock for time lock operated screw, C. E. Blechschmidt 710,417
Sand flue and netting cleaner, pneumatic, Gibson & Best 710,855
Sash attachment, window, L. Seibert 710,811
Sash fastener, J. B. Letourneau 710,590
Sash fastener, S. D. Samson..... 710,896
Sash support and lock, J. W. Shatto..... 710,720
Saw handle, detachable, C. W. Stites.... 710,904
Sawing apparatus, J. A. Brines..... 710,838
Scaffold bracket, F. Haas 710,861
Scaffold chair, L. W. Niendorff 710,602
Scraper and dumping device, combined wheeled, M. Mead 710,592
Screw driving machine, E. Finn 710,676
Seal, self-cocking, E. Tyden..... 710,634
Seed hull reducing apparatus, F. B. Pope. 710,887
Seeder, W. Fetzer 710,852
Separator. See Centrifugal separator.
Settling tank, R. D. Jackson 710,462
Sewing hooks and eyes on cards, machine for, G. Rowbottom .....710,517 to 710,519
Sewing machine, double zigzag, H. A. Klemm 710,696
Sewing machine presser foot mechanism, shoe, E. P. Richardson 710,613
Sewing machine, shoe, E. P. Richardson. 710,612
Shade and screen holder, window, J. Robertson 710,515
Sheet slitting and piling apparatus, A. J. Diescher 710,441

(Continued on page 264)


"Star" Foot and Power Screw Cutting Automatic Cross Feed Lathes
FOR FINE, ACCURATE WORK
Send for Catalogue B.
SENECA FALLS MFG. CO.
Water Street,
Seneca Falls, N. Y., U. S. A.

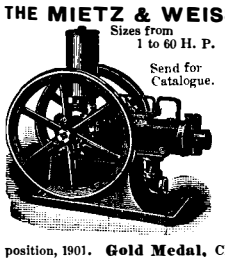
ENGINE & FOOT LATHES MACHINE SHOP OUTFITS. TOOLS AND SUPPLIES CATALOGUE FREE SEBASTIAN LATHE CO. 120 CULVERT ST. CINCINNATI, O.

"OLDS" GASOLINE ENGINES

are remarkable for SIMPLICITY and ECONOMY
Write for Prices.
Olds Motor Works,
1328 Jeff. Ave.,
Detroit, - - Mich.

Howard Two and Four Cycle MARINE AND AUTOMOBILE MOTORS

Write for Cat.
Grant Ferris Co.
Troy, N. Y.

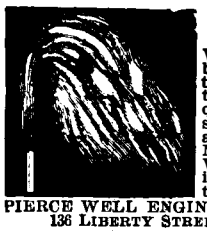
FRICTION DISK DRILL
FOR LIGHT WORK.
Has These Great Advantages:
The speed can be instantly changed from 0 to 1600 without stopping or shifting belts. Power applied can be graduated to drive, with equal safety, the smallest or largest drills within its range—a wonderful economy in time and great saving in drill breakage. ☞ Send for catalogue.

W. F. & JNO. BARNES CO.,
Established 1872.
1999 Ruby Street, - - Rockford, Ill.

THE MIETZ & WEISS KEROSENE and GAS ENGINE
Sizes from 1 to 60 H. P.

Send for Catalogue.
burns KEROSENE cheaper and safer than gasoline. Automatic, simple, reliable. No electric battery or flame used. Perfect regulation. Belted or directly coupled to dynamo for electric lighting, charging storage batteries, pumping and all power purposes.
A. MIETZ,
138-138 Mott St., New York.
ADOPTED BY U. S. GOVERNMENT. Highest Award, direct coupled Generator Set, Paris Exposition, 1900. Gold Medal, Pan-American Exposition, 1901. Gold Medal, Charleston, S. C., Exposition, 1902.

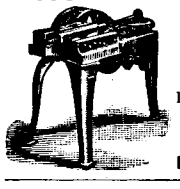
Apple Economical Gas Engine Igniters

Are positively the best built for Stationary, Automobile and Marine Gas Engines, either touch or jump spark system. We are the leaders in the manufacture of Igniting Dynamos, Magnetos, Governors, Coils, Plugs, etc. Write for printed matter. The Dayton Electrical Manfg. Company, No. 80 South St. Clair St., Dayton, Ohio, U. S. A.
New York stock carried by Chas E. Miller, 97 Reade Street, N. Y.; Philadelphia Office, The Bourse; Chicago Office, 19-21 La Salle Street. St. Louis stock carried by A. L. Dyke, Lininar Building. Boston Stock carried by Electric Gas Lighting Co., 195 Devonshire Street, Boston, Mass. Dunham, Carrigan & Hayden Co., San Francisco, Distributing Agents for Pacific Coast.


ARTESIAN
Wells, Oil and Gas Wells drilled by contract to any depth from 50 to 3000 feet. We also manufacture and furnish everything required to drill and complete same. Portable Horse Power and Mounted Steam Drilling Machines for 100 to 1200 feet. Write us stating exactly what is required and send for illustrated catalogue. Address
PIERCE WELL ENGINEERING AND SUPPLY CO.
136 Liberty Street, New York, U. S. A.

THE MIDGET DYNAMO OR MOTOR.
Weight 3¾ pounds. Will light our 6 c. p. lamp, ring bells, explode powder. Output 10 watts. As a motor will develop 1-32 h. p. Wound for voltages 4 or 6 as desired. Other voltages up to 110 to order. ☞ Send stamp for illustrated circulars.

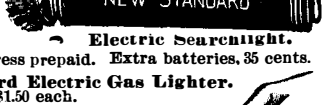
ELBRIDGE ELECTRICAL MANUFACTURING COMPANY,
Elbridge, N. Y., U. S. A.

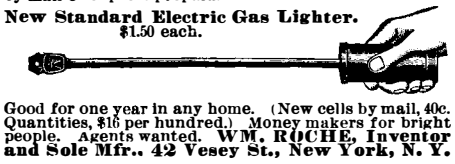
MACHINES FOR ROLLING SCREW THREADS.

Any size up to 1" diameter, 3" long. Four sizes of machines.
☞ Send for Catalogue.
BLAKE & JOHNSON,
P. O. Box 7. Waterbury, Conn.

Cutting Dies

FOR PAPER, CLOTH, RUBBER, ETC.
All kinds, for use with mallet or under a press.

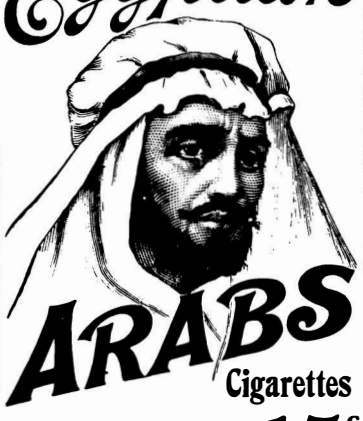
THE HOGGSON & PETTIS CO., New Haven, Conn.

Search Lights, Electric Gas Lighters.
Push the "plate" or lever, it lights. For all uses where candles, lamps, etc., are dangerous. $2 by mail or express prepaid.


Electric Searchlight. Extra batteries, 35 cents.
New Standard Electric Gas Lighter. $1.50 each.

Good for one year in any home. (New cells by mail, 40c. Quantities, $16 per hundred.) Money makers for bright people. Agents wanted. WM. ROCHE, Inventor and Sole Mfr., 42 Vesey St., New York, N. Y.

© 1902 SCIENTIFIC AMERICAN, INC.

ENORMOUSLY
The Largest SALE
Egyptian



ARABS
Cigarettes
CORK TIPS OR PLAIN 15c
SURBRUG COMPANY, Makers

A Perfect Working Monkey Wrench
WATCH CHARM.

This miniature wrench is an exact reproduction of the large monkey wrench, perfect in shape and operation, and all its parts are accurately proportioned. It is nickel plated, and has handsome pearl handle.

It is very handsome and neat, and without exception the prettiest and most appropriate watch charm any machinist or engineer can possibly possess.

40c., Pearl Handle, postage paid. Big tool cat. 10c. to pay postage.

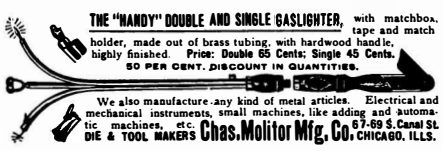
THE FRASSE CO., 38 Cortlandt St., New York.

BABBITT METALS.—SIX IMPORTANT formulas. SCIENTIFIC AMERICAN SUPPLEMENT 1123. Price 10 cents. For sale by Munn & Co. and all newsdealers. Send for catalogue.

The "Best" Light

is a portable 100 candle power light, costing only 2 cts. per week. Makes and burns its own gas. Brighter than electricity or acetylene, and cheaper than kerosene. No Dirt. No Grease. No Odor. Over 100 styles. Lighted instantly with a match. Every lamp warranted. Agents Wanted Everywhere.

THE "BEST" LIGHT CO.
87 E. 5th Street, CANTON, OHIO.



THE "HANDY" DOUBLE AND SINGLE GASLIGHTER, with matchbox, tape and match holder, made out of brass tubing, with hardwood handle, highly finished. Price: Double 65 Cents; Single 45 Cents. 50 PER CENT. DISCOUNT IN QUANTITIES.

We also manufacture any kind of metal articles. Electrical and mechanical instruments, small machines, like adding and automatic machines, etc. Chas. Molitor Mfg. Co. 67-69 S. Canal St. DIE & TOOL MAKERS CHICAGO, ILLS.

$1 YEARLY FOR REPAIRS.

It has been found that it costs a trifle less than $1 per year to keep our **Hoisting Engines** in repair. That speaks well for their superior make and durability, doesn't it? There is no more economical or serviceable engine made for mines, quarries, docks, etc. Much cheaper than steam. Both Friction and geared hoist 6 to 150 h. p.

Send for Catalog

Weber Gas & Gasoline Engine Co., P. O. Box 1114-a, Kansas City, Mo.

The FRANKLIN Model Shop

THE FRANKLIN DYNAMO

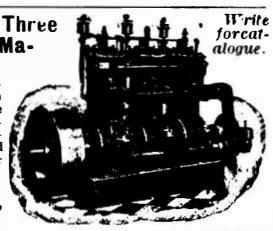
50 Watts, 10 Volts, 5 Amperes

3,000 to 4,600 revolutions. Sets of materials, finished parts, complete machines. For amateur construction - very efficient. Will drive a dental engine, sewing machine or small lathe; run as a generator, will furnish current for six 6-candle lamps. Parts, $3.50, $6.00, $8.50. Complete, $12.50. Write for circular 9.

Parsell & Weed. 129-131 W. 31st St., N.Y.

The "Wolverine" Three Cylinder Gasoline Marine Engine.

The only reversing and self-starting gasoline engine on the market. Lightest engine for the power built. Practically no vibration. Absolutely safe. Single, double and triple marine and stationary motors from ¾ to 30 H. P.



Write for catalogue.

WOLVERINE MOTOR WORKS, Grand Rapids, Mich.

JUST PUBLISHED

Practical Pointers For Patentees

Containing Valuable Information and Advice on

THE SALE OF PATENTS.

An Elucidation of the Best Methods Employed by the Most Successful Inventors in Handling Their Inventions.

By F. A. CRESEE, M. E.

144 Pages. Cloth. Price, $1.00.

THIS is the most practical, up-to-date book published in the interest of Patentees, setting forth the best methods employed by the most successful Inventors in handling their patents. It is written expressly for Patentees by a practical Inventor, and is based upon the experience of some of the most successful Inventors of the day.

It gives exactly that information and advice about handling patents that should be possessed by every Inventor who would achieve success by his ingenuity, and will save the cost of many expensive experiments as well as much valuable time in realizing from your inventions. It contains no advertisements of any description and is published in the interests of the Patentee alone, and its only object is to give him such practical information and advice as will enable him to intelligently handle his patent successfully, economically and profitably.

It gives a vast amount of valuable information along this line that can only be acquired by long, expensive experience in realizing from the monopoly afforded by a patent.

Send for Descriptive Circular.

MUNN & CO.,
Publishers, 361 Broadway, New York.

Shoe brushing machine, C. A. Sundgren	710,628
Siphon, W. C. Muntzer	710,598
Siphon, automatic, S. W. Miller	710,703
Siphon head for soda water bottles, etc., J. V. Fassmann	710,674
Skate runner, P. M. Stromsem	710,537
Skirt protector, G. S. Hensel	710,687
Slag, molding, S. Norton	710,882
Smoke bell, B. Barnett	710,834
Snap hook, J. C. Myers	710,497
Snow plow, W. W. Foss	710,853
Speed varying transmission, Reeves & Hood	710,714
Spike extractor, E. J. Kennedy	710,468
Spring, M. H. Naber	710,502
Square, J. Phillips	710,509
Square, tailor's, G. Adamo	710,399
Square, try, S. R. Pugh	710,891
Stairway, J. Piccardi	710,886
Starch, utilizing by-products of the manufacture of, A. S. Hoyt	710,461
Starting mechanism for prime movers, C. M. Manly	710,486
Steam boiler, sectional, H. Bradley	710,420
Steam separator, J. Angell	710,654, 710,655
Steam shovels, excavators, etc., apparatus for moving, H. Crowe	710,764
Sterilizing machine, C. A. King	710,784
Storage battery, H. P. King	710,870
Stove, A. M. Lanner, reissue	12,043
Stove, W. V. Robinson	710,616
Stove, heating, J. B. Howard	710,460
Stove, self-cleaning hot blast, J. W. Cabot	710,748
Stoves, interior charcoal attachment for cooking, R. Fletcher	710,571
Sugar juice, defecating, J. A. Besson	710,413
Swing, W. S. Tothill	710,633
Tank. See Settling tank.	
Tank alarm device, Kubitzky & Stewart	710,872
Tank for storing compressed hot air, C. A. Bartliff	710,405
Tank mold, A. P. Morris	710,596
Telegraph instruments, apparatus for perforating tape for automatic, J. Gell	710,448
Tellurian, C. S. Henderson	710,454
Terpene peroxid, chemical compound, A. S. Ramage	710,893
Time checker, workman's, J. Corbett	710,430
Timepiece escapement, F. H. Voigt	710,823
Tire, cushion, C. Miller	710,595
Tire, pneumatic, F. Mitchell	710,793
Tire, pneumatic vehicle wheel, P. de Caters	710,562
Tobacco pipe, A. Berninger	710,740
Tongs, grappling, C. C. Carter	710,424
Tooth members, means for attaching, W. H. Dwight	710,444
Toothpick, D. McClain	710,498
Toy battleship, knockdown, C. T. Bonn	710,560
Toy, detonating, W. J. Somerwill	710,531
Toy gun, magazine, I. T. Smith	710,723
Toy, magnetic, L. J. Sullivan	710,627
Traction wheel, magnetic, B. B. Hill	710,691
Trolley, J. F. Kerr	710,465
Trolley wire ice cleaner, F. N. Root	710,516
Truck, car, C. Vanderbilt	710,637
Truck frame, motor car, A. Schmid	710,809
Truck, hand, E. M. Cummins	710,845
Tub. See bathing tub.	
Tube cleaner, F. Nowotny	710,798
Tube making machine, F. C. Osborn	710,507
Tumbler washer, I. Johnson	710,463
Turbo compressor and pump, C. A. Parsons	710,884
Twisting and winding machine, A. S. Horlacher	710,459
Typewriting machine, E. V. Baillard	710,401
Typewriting machine, C. H. Shepard	710,812
Typewriting machine support, C. W. Boyd	710,561
Umbrella notch, Climenson & Winger	710,426
Umbrella rack, folding, A. W. Magerhans	710,790
Umbrella rib and stretcher joint, Climenson & Winger	710,427
Valve, P. E. Gonon	710,450
Valve, J. A. Arnold	710,735
Valve and valve mechanism for gas engines, W. O. Worth	710,728
Valve for water mains, automatic air, C. E. Loetzer	710,480
Valve, gas or gasolene engine, A. P. Brush	710,840
Valve, gas or gasolene engine mixing, A. P. Brush	710,841
Valve mechanism, O. Swenson, Sr.	710,905
Valve, steam engine governor, H. B. Wyman	710,729
Vegetable washer, Butler & Larson	710,422
Vehicle brake mechanism, C. Metterhausen	710,877
Vehicle, dumping, G. R. Werner	710,909
Vehicle, motor, C. F. Thoms	710,630
Vehicle seat, adjustable two wheeled, A. Johnston	710,582
Vehicle wrench, L. Davis	710,847
Velocipede drive and brake mechanism, J. S. Copeland	710,844
Vessels, hoisting apparatus for wrecking, S. Lake	710,472
Violin bow, E. C. McElhany	710,499
Vise, bench, J. R. Long	710,482
Wagon brake, L. P. Akins	710,651
Wagon, chute, A. Ray	710,611
Wagon, dumping, J. W. Johnson	710,868
Wall, building, Zimmermann & Doerr	710,830
Walls, mold for building concrete or cement, W. H. Cadwell	710,749
Wardrobe, folding, H. M. Greenfield	710,680
Water bag, Hogan & Meinecke	710,864
Water column, W. P. Phillips	710,801
Water courses and conveying material therefrom, apparatus for exposing the beds of, J. W. Stanecart	710,813
Water heater, D. D. Shaw	710,528
Water wheels, etc., governor for, L. Lyndon	710,788
Weather strip, M. K. Little	710,478
Weather strip, W. Steger	710,926
Well casings, drive head for gas, oil, or other, G. H. Guthrie	710,860
Whiffletree hook, C. S. Grindell	710,573
Window, combination storm and screen, C. W. Berger	710,661
Window, prismatic glass, G. K. Cummings	710,434
Woodworking clamp, C. C. Wandell	710,544
Woven fabric, H. Hardwick	710,775
Wreck raising apparatus, Johnson & Jacobson	710,869
Yarns, etc., apparatus for drying and conditioning, Keith & Wardle	710,467

DESIGNS.

Bottle, F. Schilling	36,097
Brooch or similar article, C. H. Such	36,094
Glassmaker's stock, K. Booth	36,098
Sewing machine cabinet, F. G. Hogland, 36,100,	36,101
Shade cloth, J. H. Wright	36,102
Spoons or similar articles, handle for, N. H. Andrus	36,095
Spoons or similar articles, handle for, C. S. Court	36,096
Stove, heating, Kennedy & King	36,099

TRADE MARKS.

Agricultural implements, certain named, Warder, Bushnell & Glessner Co. 39,011,	39,012
Almonds, shelled, W. H. Wiley & Co.	38,997
Bicycles and self-propelled road vehicles, G. M. Hendee	39,008
Bitters or tonics, stomach, F. S. Amidon	39,003
Bread, Listman Mill Co.	38,994
Brushes, Palmetto Fiber Co.	38,977
Cheese, Brinker & Schweiner	38,991
Cleaning and polishing preparations for metal, glass, and similar materials, I. M. O'Brien	38,988
Corsets, Weingarten Bros.	38,979
Corsets, G. C. Batcheller	38,980
Cotton piece goods not figured or printed, unbleached, Ashton, Hoare & Co. 38,981,	38,982
Cotton threads and yarns, Summit Thread Co.	38,985
Crayons and pencils, Binney & Smith	38,975
Creme de menthe, Nuyens & Co.	39,000
Fabrics, cotton, G. Sidenberg & Co.	38,983
Fire extinguishers, Haverhill Fire Appliance Co.	39,010
Flour, wheat, T. J. Coyle	38,995
Food, certain named prepared, Wahl Food Co.	38,992

(Continued on page 265)

Not what is said of it, but what it does, has made the fame of the

Elgin Watch

and made 10,000,000 Elgins necessary to the world's work. Sold by every jeweler in the land; guaranteed by the greatest watch works.

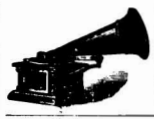
ELGIN NATIONAL WATCH CO.
ELGIN, ILLINOIS.

Wire Cloth, Wire Lath, Electrically-Welded Wire Fabrics

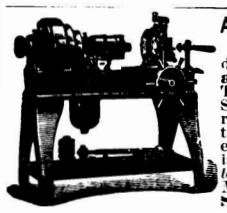
and Perforated Metal of all Kinds

Manufactured by

CLINTON WIRE CLOTH COMPANY, CLINTON, MASS.
BOSTON NEW YORK CHICAGO SAN FRANCISCO



SAVE 50 PER CENT ON PHONOGRAPHS, CELEBRATED VICTOR TALKING MACHINES, SUPPLIES, RECORDS, HORNS, REPRODUCERS ETC. BUY FROM THE LEADING SUPPLY HOUSE. ILLUSTRATED CATALOG FREE. TALKING MACHINES.
BROADWAY CYCLE CO.
7 WARREN ST. NEW YORK



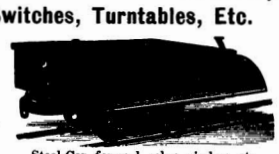
A Marvelous Machine!

Watch the wonderful work done by our **Apex Nipple and Pipe Mill Machine.** Threads nipples of all sizes. So swiveled that it can be reversed and pipe cut off close to grippers. Vise can be opened or closed while machine is in motion. *Send for Catalogue.* THE MERRELL MFG. CO., 501 Curtiss Street, Toledo, Ohio.

STEEL DUMP CARS,

Rails, Switches, Turntables, Etc.

and all Accessories Always in Stock.



Steel Car, for coal, ashes, cinders, etc.

ARTHUR KOPPEL, Dept. P, 66-68 Broad St.,
Write for Catalogue No. 30. New York.

DANGER IN DRINKING WATER

Nothing is more likely to cause disease than impure drinking water. The precaution is to render water pure before drinking. This is quickly and easily done with the scientifically perfect

BERKEFELD FILTER

whose cylinders of infusorial earth retain every particle of solid matter and prevent contamination. Easy to clean and care for.

BERKEFELD FILTER CO., 4 Cedar Street, New York

NEW CINCINNATI FIRM.

The "Rapid" Tool and Machine Co., of 814, 816, and 818 Broadway, Cincinnati, O.,

have just completed a manufacturing plant and are ready to take orders for general tool and die sinking, metal engraving, metal stamping, metal patterns and models, designing and building of special machinery for rapid manufacturing of small metal goods, toys and notions. They will manufacture by contract for the wholesale trade and have made a specialty of working sheet aluminum. They are fixed up to make a fine piece of work in aluminum spinning and also in manufacturing aluminum castings for any purpose. They are equipped to do mechanical as well as electrical experimental work. Patent Office models and guarantee their work.

FREE

SPECIAL OFFER to the Readers of The Scientific American.
Good for 30 days.

A Beautiful Imported China Tea Set (56 pieces), or Toilet Set, Parlor Lamp, Clock, Watch, and many other articles too numerous to mention **FREE** with club order of 20 lbs. of our New Crop Tea, 60c. a lb., or 20 lbs. of Great American Baking Powder, 25c. a lb. This advertisement must accompany order by mail or at store.

THE GREAT AMERICAN TEA CO.,
P. O. Box 289. 31 and 33 Vesey St., New York.

VELOCITY OF ICE BOATS.—A COLlection of interesting letters to the editor of the SCIENTIFIC AMERICAN on the question of the speed of Ice Boats, demonstrating how and why it is that these craft sail faster than the wind which propels them. Illustrated with 10 explanatory diagrams. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 214. Price 10 cents. To be had at this office and from all newsdealers.

"D. and J." HANGERS are **Absolutely the BEST.**

WHY?

They are Mechanically Correct, Accurately Ground, Lightest, Nearest Dust and Water-Proof, Neatest in appearance, and they are used by the best Manufacturers and ridden by the best Professionals and Amateurs of America.

Park City Mfg. Co., Inc., Chicago.

D. L. HOLDEN
REAL ESTATE TRUST BLDG, PHILA., PA.
SOLE MANUFACTURER
REGEALED ICE MACHINES
SEE FIRST PAGE SCIENTIFIC AMERICAN SEPT 2 1899

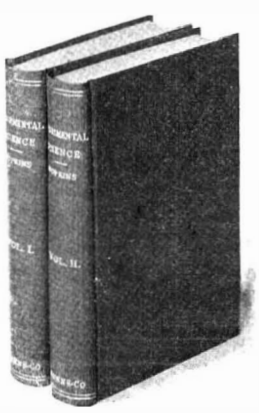
.... NOW READY ....

Twenty-Third Edition

Experimental Science

BY George M. Hopkins

Revised and Greatly Enlarged.
2 Octavo Volumes.
1,100 Pages. 900 Illustrations.
Cloth Bound, Postpaid, $5.00.
Half Morocco, Postpaid, 7.00.
Or Volumes Sold Separately:
Cloth, $3.00 per Volume.
Half Morocco, $4.00 per Volume.



EXPERIMENTAL SCIENCE is so well known to many of our readers that it is hardly necessary now to give a description of this work. Mr. Hopkins decided some months ago that it would be necessary to prepare a new edition of this work in order that the many wonderful discoveries of modern times might be fully described in its pages. Since the last edition was published, wonderful developments in wireless telegraphy, for example, have been made. It was necessary, therefore, that a good deal of new matter should be added to the work in order to make it thoroughly up-to-date, and with this object in view some 200 pages have been added. On account of the increased size of the work it has been necessary to divide it into two volumes, handsomely bound in buckram. It may be interesting to note the following additions that have been made to these volumes:

Volume I contains in addition to a large number of simple, well illustrated experiments, a full description of a ¼ H. P. electric motor made expressly for illustration in this edition of "EXPERIMENTAL SCIENCE." It is an ENCLOSED SELF-REGULATING electric motor for a 110 volt circuit. It can be operated by a current from a 110 volt lamp-socket, yielding a full ¼ H. P., or it may be used as a dynamo, furnishing a current capable of operating three 16-candle power, 110 volt incandescent lamps. The construction of the machine is perfect enough to admit of enlarging or reducing its size if desired.

Volume II contains much on the general subject of electricity, besides new articles of great importance. Among these the subject of alternate current machinery is treated. Wireless Telegraphy and Telephony receive attention. Electrical Measuring Instruments, The Electric Clock, The Telegraphone, Experiments in High Voltage, The Nernst Lamp, and Measuring the Heat of the Stars are all thoroughly illustrated and described.

The unprecedented sale of this work shows conclusively that it is the book of the age for teachers, students, experimenters and all others who desire a general knowledge of Physics or Natural Philosophy.

SEND FOR DESCRIPTIVE CIRCULAR.

MUNN & CO., Publishers, 361 Broadway, New York.

© 1902 SCIENTIFIC AMERICAN, INC.

WAR OFFICE COMPETITION FOR TRACTORS FOR MILITARY PURPOSES.

The Competition for Tractors for Military Purposes which was announced for the Spring of 1903 will be postponed until the month of October, 1903.

Intending Competitors should apply on the 1st of October, 1902, for forms of entry for this Competition to the Secretary,

Mechanical Transport Committee,
War Office, Horse Guards,
Whitehall, S. W.

These forms must be completed and returned to the Secretary, Mechanical Transport Committee, not later than January 1, 1903.

ELECTRICAL ENGINEERING TAUGHT BY MAIL.

Write for our Free Illustrated Book.
"CAN I BECOME AN ELECTRICAL ENGINEER?"

We teach Electrical Engineering, Electric Lighting, Electric Railways, Mechanical Engineering, Steam Engineering, Mechanical Drawing, at your home by mail. Institute indorsed by Thos. A. Edison and others.
ELECTRICAL ENGINEER INSTITUTE,
Dept. A, **240-242 W. 23d St. New York.**

Tuition Free

in the following courses for home study:
Illustrating, Ad.-Writing, Journalism, Proofreading, Bookkeeping, Stenography and **Practical Electricity.** You pay us no Tuition Fee until we have secured a position for you. Mention subject that interests you.
CORRESPONDENCE INSTITUTE OF AMERICA,
Box 689, Scranton, Pa.

LEARN PROOFREADING. If you possess a fair education, why not utilize it at a genteel and uncrowded profession paying $15 to $35 weekly? Situations always obtainable. We are the original instructors by mail.
HOME CORRESPONDENCE SCHOOL, Philadelphia.

The Typewriter Exchange

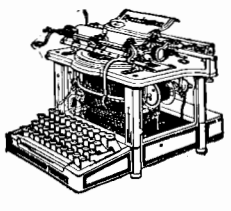
1½ Barclay St., NEW YORK
124 La Salle St., CHICAGO
38 Bromfield St., BOSTON
817 Wyandotte St., KANSAS CITY, MO.
209 North 9th St., ST. LOUIS, MO.
536 California St., SAN FRANCISCO, CAL.

We will save you from 10 to 50% on Typewriters of all makes. *Send for Catalogue*

CALIFORNIA
Reliable Information
about vegetable gardening, grain growing, fruit culture, poultry, climate, soil, water, lands, power, markets, manufacturing facilities, wages, etc.
For printed matter and other information write
CALIFORNIA PROMOTION COMMITTEE
Representing state commercial organizations
Dept. K. K. 25 New Montgomery St.,
SAN FRANCISCO, CALIFORNIA

OIL--SMELTER--MINES
Dividend-Paying Mining, Oil and Smelter Stocks, Listed and Unlisted, our Specialty.
DOUGLAS, LACEY & CO.
Bankers & Brokers, Fiscal Agents,
Members N. Y. Consolidated Stock Exchange.
66 BROADWAY & 17 NEW ST., NEW YORK.
Booklets giving our successful plan for realizing the **large interest and profits** of legitimate mining, oil and smelter investments, sub. blanks, full particulars, etc., **sent free on application.**

EVERYBODY
finds the



Remington Typewriter
adapted to his work

Wyckoff, Seamans & Benedict
(REMINGTON TYPEWRITER COMPANY)
327 Broadway, - New York

Food, prepared cereal, American Cereal Co.	38,993
Fruits, certain named dried and evaporated, Hancock & Co.	38,996
Greases employed in soap making, Aspegren & Co.	38,989
Ice cream and candies, Schell & Co.	38,998
Knives, pocket, J. Curley & Brother	38,976
Lifting jacks, hand, Covert Manufacturing Co.	39,009
Medical compound for treatment of nervous diseases and as a tissue builder and general tonic, J. H. Kastle	39,005
Medicine, tonic, Biogene Manufacturing Co.	39,002
Mineral water, H. L. Williams & Co.	38,999
Ointment or salve, E. Schmidt & Co.	39,006
Remedy for diseases of the stomach and kidneys, A. Warren	39,004
Rubber boots and shoes, Russian-French India Rubber, Guttapercha and Telegraph Works, "Prowodnik, Riga"	38,987
Sheetings and drills, cotton, Piedmont Manufacturing Co.	38,984
Soap, castile, J. S. Nicholas	38,990
Sponges and washcloths, A. Frankenberg	38,986
Tires, solid rubber, Goodyear Tire & Rubber Co.	39,007
Tonic, Frederick Sterns & Co.	39,001
Underwear and hosiery, woven and knitted, G. W. Schlichten	38,978
Watches and watch movements, H. F. Hahn & Co.	38,974

LABELS.

"Battle," for coffee, Southern Coffee Co.	9,476
"Italy Brand," for olive oil, Parodi, Erminio & Co.	9,477
"Pine Needle Toilet Powder," for toilet powder, F. K. Hickok	9,478
"Red Lion Stomach Bitters," for stomach bitters, Stein Brothers	9,481
"Rosaderma," for complexion compound, E. W. Rose	9,479
"Star Five Cent Concentrated Horse Food," for horse food, Rudolph & Huber	9,475
"Uncle Sam Did It! Can You?" for a puzzle, L. F. Jordan	9,474
"X-Ray Stove Polish," for stove polish, Blazer Manufacturing Co.	9,480

PRINTS.

"Table Tennis," for table tennis, Gray Lithograph Co.	560
"The First Over the Bars, Hunter Baltimore Rye," for whisky, W. Lanahan & Son	559
"Uncle Sam Suspenders," for suspenders, Consolidated Manhattan Suspender Co.	561

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., 361 Broadway, New York.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled

(8720) J. L. B. asks: 1. What battery shall I use, and how many cells of the same, to light two 8 candle power lamps of 8 volts and 2 amperes? A. Five cells of the plunging bichromate battery will light two 8-volt 2-ampere lamps. The battery is described in SCIENTIFIC AMERICAN SUPPLEMENT No. 792. 2. Why is the magnet in a telephone receiver permanent? A. The magnet in a telephone is permanent in order to furnish the field of force which causes the current in the transmitter to vary with the vibrations of the diaphragm. An electro-magnet would be more expensive and difficult to maintain. 3. What is the difference in construction of a direct current and an alternating current motor? A. A direct-current motor has a commutator, an alternating-current motor has rings to receive the current. The windings of the alternating-current motor are designed for the forms of current, as single or multiphase, while in some forms there is only one set of windings. To learn all the points of difference you should study the books on the subject. A good general work on electricity is Thompson's Lessons.

(8721) C. T. M. asks: What is meant by a twenty per cent grade? A. A twenty per cent grade rises or falls 20 feet for every 100 feet measured horizontally and not on the slope. In other words, the grade is measured by the tangent of the angle of inclination and not by its sine, so that a 100 per cent grade corresponds to an inclination of 45 deg. and not to an inclination of 90 deg. A slope, as of an embankment, is usually designated as of so many to 1; for instance, the usual slope of earthwork is 1½ to 1, meaning 1½ horizontal to 1 vertical. But, conversely, the grade of a road is sometimes given as of 1 in so many, meaning a rise or fall of 1 foot vertically for so many feet measured horizontally; for instance, **a grade of 1 in 20 would be a 5 per cent grade and of 1 in 5 would be a 20 per cent grade.** You will find such matters explained in Trautwine's "Civil Engineer's Pocke

PERFORATED METALS.
FOR ALL USES, MADE AS REQUIRED.
THE HARRINGTON & KING PERFORATING CO.
225 N. UNION ST. CHICAGO, ILL. U.S.A.

WANTED by prominent and best introduced firm on the European Continent, sole agency for a practical and solid **Typewriting Machine.** Large and rapid success for the right machine. Address with cash terms and full details, sub F. O. 5544, care of RUDOLF MOSSE, Berlin, S. W., Germany.

CREST
3, 5, 7 H. P. MOTORS.
Sparking Plugs and Coils.
CREST MFG. CO.,
Cambridge, Mass.

ELECTRICITY. **HOW TO MAKE. 10 Cts.** A Dynamo, Storage Battery, Wimshurst Machine, Telegraph Instrument, Electric Bell, 5 Books, 10 cents each.
Bubier Pub. Co., Box Y, Lynn, Mass.

BERRYMAN Heaters
BENJ. F. KELLEY & SON, 91 Liberty St., New York.
Manufacturers of the (KELLEY PATENT) Improved Berryman water tube Feed Water Heater and Purifier. A thoroughly up-to-date, reliable and efficient heater. Made to stand the highest pressure and so constructed as to be utterly indestructible by the heaviest boiler pressure it is possible to carry. Write for catalogue.

SMALL SPRINGS OF EVERY DESCRIPTION
FLAT OR ROUND WIRE. STEEL OR BRASS.
THE WALLACE BARNES Co 18 MAIN ST. BRISTOL, CONN.

2d HAND GAS and GASOLINE ENGINES
Save 30 to 50 per cent. Second hand engines in stock from 1 to 20 h. p., all makes, all prices. Suitable for every power purpose. We can meet your wants. All engines in thorough order and guaranteed. Write for illustrated lists and state your wants.
Callison Motor Co., 271 West St., New York.

FREE Catalogue of Architectural, Scientific and Technical Books.
Prospectus for 1902, for "Architects' and Builders' Magazine," monthly $2 a year.
WM. T. COMSTOCK. Pub., 23 Warren St., New York.

MODELS & GEARS CATALOGUES FREE. UNION MODEL WORKS 193 CLARK CHICAGO.

DRAFTSMEN WANTED. — AN EXAMINATION for Marine Engine and Boiler Draftsmen, Assistant Marine Engine and Boiler Draftsmen, and Copyist Marine Engine and Boiler Draftsmen, to provide an eligible list from which appointments will be made in the Naval Service at any time within three years thereafter, will be held at the Navy Yards, New York, League Island and Washington, continuing through November 5, 6 and 7, 1902, between the hours of 9.30 A. M. and 4.00 P. M., each day. The examinations will be identical at all the Yards, and will be practical in character. Applications for permission to be examined, designating also the Yard most convenient for the applicant, should be made previous to November 1, 1902, to the Secretary of the Navy, Navy Department, Washington, D. C., who will supply the necessary forms and instructions. Pay, $2.80 to $5.04 per diem.

"THIS BEATS NEW JERSEY."
Charters procured under South Dakota laws for a few dollars. Write for Corporation laws, blanks, by-laws and forms to PHILIP LAWRENCE, late Ass't Secretary of State, Huron, Beadle Co., South Dakota.

MODELS, DIES AND PUNCHES, Special Machinery, Wood and Metal Patterns, Stampings, etc.
Hoeft & Moore, 85 and 87 Fifth Ave., Chicago.

MATCH **Factory Machinery.** W. E. WILLIAMS, Mfr., 217 South Clinton St., Chicago, U. S. A.

ICE **MACHINES, Corliss Engines, Brewers' and Bottlers' Machinery.** THE VILTER MFG. CO., 899 Clinton Street, Milwaukee Wis.

MODELS & EXPERIMENTAL WORK.
Inventions developed. Special Machinery.
E. V. BAILLARD, Fox Bldg., Franklin Square, New York.

STEEL TYPE WRITER TYPE
TYPE WHEELS, MODELS & EXPERIMENTAL WORK, SMALL MACHINERY NOVELTIES & ETC. NEW YORK STENCIL WORKS 100 NASSAU ST N.Y.

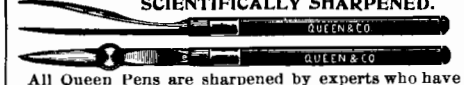
MODEL and EXPERIMENTAL WORK
Mechanical and Electrical Engineer. Drawings and Designs for Special Work.
CHAS. W. GRAHAM, 106 E. 28th Street, New York.

EXPERT MODEL **MAKERS,** Models, Patterns, Dies & Novelties. Experimental work. WAGNER MFG. CO., 9 Mohawk St., Chicago, Ill.

YOU ONLY RISK $1

In order to keep things moving during the hot weather, on receipt of $1.00, I will ship to any station in the United States **A 400-LB. WILLARD STEEL RANGE.** Guaranteed in every respect. It has six 8-inch lids; oven, 17x12x21. Top cooking surface, 30x36. Large warming closet. 15-gallon reservoir. Duplex grates, burn wood or coal. Lined throughout with asbestos. On arrival, if you are perfectly satisfied, pay the agent $14.00 and freight. You only risk $1.00 to find out what can be saved by being wide-awake. FOR FREE DESCRIPTIVE CIRCULAR AND TESTIMONIALS, WRITE
WM. G. WILLARD, Dept. 14, 619-621 N. 4th St., ST. LOUIS, MO.

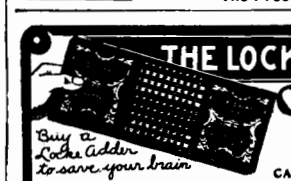
THE "QUEEN" DRAWING PENS.
SCIENTIFICALLY SHARPENED.



All Queen Pens are sharpened by experts who have had many years' experience in making and sharpening Drawing Pens. Only the finest English Steel is used in the Queen Pens, and they are hand-made and carefully tempered by our improved process. **QUEEN & CO., Inc.,** Mathematical, Engineering and Scientific Instrument Makers, **1010 Chestnut St., Philadelphia.**

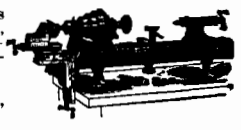
I PRINT MY OWN CARDS
Circulars, newspaper. Press, **$5.** Larger size, **$18.00.** Money saver. Big profits printing for others. Type setting easy, rules sent. Write for catalog, presses, type, paper, etc., to factory, **The Press Co., Meriden, Conn.**

THE LOCKE ADDER



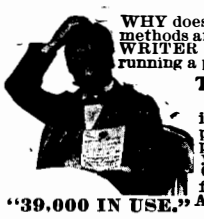
Only $5
CAPACITY 999,999,999
Patent, simplest, handiest, most practical and durable, low-priced calculating machine. Adds, Subtracts, Multiplies, Divides. **Cannot** make mistakes. Computes nine columns simultaneously. Saves time, labor, brain. Lasts a lifetime. Booklet free.
C. E. LOCKE M'F'G CO. 25 Walnut St., Kensett, Iowa

Van Norman Universal Bench Lathes
with line of attachments for screw cutting, milling, grinding, etc., are splendidly adapted for fine experimental work, etc.
Send for catalog.
Waltham Watch Tool Co., Springfield, Mass.



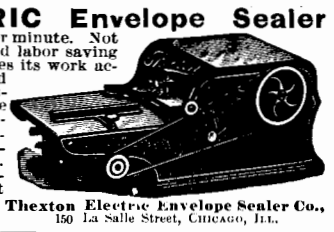
THE OMNIGRAPH Will Teach Telegraphy absolutely correct in the shortest possible time at a total cost of four dollars. **TRANSMITTER,** Key and Sounder. Expert operator with you all the time. Circular free.
THE OMNIGRAPH MFG. CO. Dep. 62, 39 Cortlandt St., New York

Use any pen and your own stationery. If your stationer does not keep it, write for free specimen of work. Beware of infringements. Address Dept. I.
Pen-Carbon Manifold Co., 145-7-9 Centre St., New York.



WHY doesn't Jones get down to business methods and buy an AMERICAN TYPEWRITER for $10. Does he think I am running a puzzle department?
THE AMERICAN $10 TYPEWRITER
is as well made as the highest-priced machines, but more simple. It has stood the test: ten years without a competitor. Catalogue and sample of work free if you mention S. A.
"39,000 IN USE." **American Typewriter Comp'y,** 267 Broadway, New York.

ELECTRIC Envelope Sealer
Capacity, 150 per minute. Not only a time and labor saving device, but does its work accurately and neatly. Endorsed by both large and small mailers as most practical. A machine of merit. Write for catalogue B and list of users.



Thexton Electric Envelope Sealer Co.,
150 La Salle Street, CHICAGO, ILL.

HARPERS

The **MAID-AT-ARMS**

Illustrated by Christy

1.50

This important novel of love and adventure deals with the early "patroon" families of New York.

by
Robert W. Chambers
Author of **"CARDIGAN"**

HARPER & BROTHERS, Franklin Square, New York

© 1902 SCIENTIFIC AMERICAN, INC.

THOROUGH INSPECTIONS AND INSURANCE AGAINST LOSS OR DAMAGE TO PROPERTY AND LOSS OF LIFE AND INJURY TO PERSONS CAUSED BY STEAM BOILER EXPLOSIONS

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO. HARTFORD, CONN.

J. M. ALLEN, PRESIDENT — W. B. FRANKLIN, VICE PRESIDENT
J. B. PIERCE, SECRETARY — F. B. ALLEN, 2D VICE PRESIDENT
L. R. BRAINERD, TREAS. — L. F. MIDDLEBROOK, ASST SEC'Y

THE NEW WINTON

Beyond question the most luxurious and complete high grade automobile ever manufactured in America.

It will be in the hands of agents and at our branch depots in a very few weeks. Twenty H. P. motor, new body design, etc.

If interested in knowing more, write us.

THE WINTON MOTOR CARRIAGE CO.,
Factory and General Offices, CLEVELAND, O., U.S.A.
NEW YORK CHICAGO BOSTON PHILADELPHIA

Waltham Watches.

"All in good time."

"The Perfected American Watch," an illustrated book of interesting information about watches, will be sent free upon request.

American Waltham Watch Company, Waltham, Mass.

FOR MEN OF BRAINS
Cortez CIGARS
MADE AT KEY WEST

These Cigars are manufactured under the most favorable climatic conditions and from the mildest blends of Havana tobacco. If we had to pay the imported cigar tax our brands would cost double the money. Send for booklet and particulars.

CORTEZ CIGAR CO., KEY WEST.

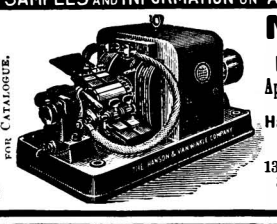
BARGAIN IN MOTORS
Five H. P. Duplex Motors for $115

Having contracted for a larger number of these popular air-cooled motors than we are able to use this season, and as we wish to turn them into ready money, we offer a few at a price previously unheard of. Write immediately for information to
THE LOOMIS AUTOMOBILE CO., WESTFIELD, MASS.

AUTOMOBILE
Parts and Castings

We sell castings of Gasoline Engines 1 to 12 H. P.
They are fine for Boat Engines also.
Auto Supplies. Get our Catalog—500 illus.
A. L. DYKE,
Vandeventer & Washington Aves., St. Louis, Mo.

COLD GALVANIZING.
AMERICAN PROCESS. NO ROYALTIES.
SAMPLES AND INFORMATION ON APPLICATION.



SEND YOUR BUSINESS CARD FOR CATALOGUE.

NICKEL AND Electro-Plating Apparatus and Material.
THE Hanson & Van Winkle Co.,
Newark, N. J.
136 Liberty St., N. Y.
30 & 32 S. Canal St. Chicago.

The GROUT STEAM CARRIAGE

Runs when you want it to for business or for pleasure.

GROUT BROS., ORANGE, MASS.

POTTER'S "SPRING" BRAKE BLOCKS. Adapts the whole length of shoe to wheel under all circumstances. Does not squeak, rattle, jump, or freeze up. Will hold rubber wear shoes without bolts or screws. Special Concave Shoes for Rubber Tire. Morgan Potter, Fishkill-on-Hudson, N. Y., U. S. A.

OUR STEAM CARRIAGES EXCEL IN
RELIABILITY

Ease of Handling, Running Qualities, Strength and Finish. Impossible to tell all about them here. Write us for catalogue. Inquiries cheerfully answered. Desirable agents wanted.

The Conrad Motor Carriage Company,
1417 Niagara St., BUFFALO, N. Y.

WE GUARANTEE ACCURACY

in all gear—rack and ratchet patterns—easy and perfect running and assured durability if the teeth are shaped and spaced with our machines. They ensure mathematically perfect work. Send for free descriptive booklet.
BUFFALO GEAR & PATTERN WORKS, Buffalo, N. Y.

POWER AIR PUMP FOR STEAM CARRIAGES
MALTBY
ADDRESS No. 11 CLINTON ST. BROOKLYN, N.Y.

Scales All varieties at lowest prices. Best Railroad Track and Wagon or Stock Scales made. Also 1000 useful articles, including Safes, Sewing Machines, Bicycles, Tools, etc. Save Money. Lists Free. CHICAGO SCALE CO., Chicago, Ill.

MAGIC LANTERNS
STEREOPTICONS and VIEWS
for Public Exhibitions, Church Entertainments, for illustrating sermons. Many sizes, all prices. Chance for men with little capital to make money. 260 page catalogue free.
McALLISTER. Mfg. Optician. 49 Nassau Street, N. Y.

It Is SELF-CLEANING

The Drake Acetylene Burner is not only self-cleaning, but has adjustable alignment and can be re-tipped, making it as good as new. Two styles, costing 30c. & 25c. respectively; $2.25 & $3.00 per doz. Send for Cat.
Drake Acetylene Apparatus Co., 39 Hathaway St., Cleveland, O.

JESSOP'S STEEL THE VERY BEST FOR TOOLS, SAWS ETC.
WM JESSOP & SONS LTD 91 JOHN ST. NEW YORK

Orient Motor Cycle.

PRICE $250.00
Fitted with the New Orient 3 H. P. Motor.
Speed over 40 Miles per hour.
The Most Powerful Motor Bicycle in the World.
Write for Particulars. Agents Wanted.
WALTHAM MFG. CO., Waltham, Mass.

DICKERMAN'S DURABLE DESKS
AMERICAN DESK & STOOL CO., 33 Howard St., just East of 434 B'way. New York City.

THE WHITE STEAM CARRIAGE

WHAT THE WHITE HAS DEMONSTRATED

THE fitness of an automobile for general use must be proved by actual results—not by theoretical statements. These are the facts about the WHITE STEAM CARRIAGE:

WHITE RELIABILITY—Has made a clean record in endurance contests whenever entered. Out of a field of 70 starters in England's recent endurance run, only two earned the highest possible score. Of these one was a WHITE taken from regular stock.

WHITE SPEED—Has repeatedly established new figures for World's records, making five miles in 6:43 1-5 and ten miles in 14:59½.

WHITE ECONOMY—In a run of 100 miles without stop, the WHITE used only 5¾ gallons of fuel and 6 gallons of water.

Write for full particulars, including Prof. Thurston's report on our steam generator, and the official reports of important endurance contests.

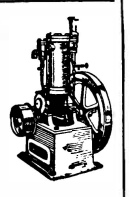
WHITE SEWING MACHINE CO. (*Automobile Department*), Cleveland, Ohio

22 Union Square, New York, N. Y.
509 Tremont Street, Boston, Mass.
300 Post Street, San Francisco, Cal.
609 Main Street, Buffalo, N. Y.
12 Woodward Avenue, Detroit, Mich.
300 Rose Building, Cleveland, Ohio.

$750

HYDRO-CARBON.
20-Mile Speed.
20 per cent. Grades.
100-Mile Gasoline Tank.
300-Mile Water Tank.
900 lbs. 6 H. P. Actual.
Write for Catalogue.
FRIEDMAN AUTOMOBILE CO.,
8 E. Van Buren Street. Chicago, Ill.

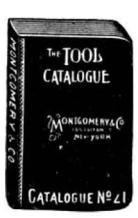
CHARTER ENGINE



USED ANY PLACE BY ANY ONE FOR ANY PURPOSE
Stationaries, Portables, Sawing Outfits, Hoisters, Engines and Pumps.
FUEL—Gasoline, Gas, Distillate.
Send for Illustrated Catalogue and Testimonials, and State Your Power Needs.
CHARTER GAS ENGINE CO., Box 148, STERLING, ILL

COLD GALVANIZING

Save all the Spelter consumed in galvanizing by the hot process by using our Patent Cold Galvanizing Process, as the amount of spelter lost as dross in the hot process if used in our process will give sufficient protection to any kind of work to make it rust-proof even against salt air and sea water. Our Patent Process is now in use all over the country. Our licensees include U. S. Government, The Standard Oil Co., Herreshoff Boat Building Co., Townsend & Downey, Armour Packing Co. Licenses granted on royalty basis. Sample and custom work done at our factory, 108-110 W. 11th St. Main Office, 348 Broadway. U. S. ELECTRO-GALVANIZING CO.

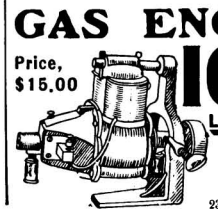


Send For It To-Day

You'll find it always convenient to have as a useful and instructive book
Montgomery & Co.'s Tool Catalogue
The new edition has 704 pages and is copiously illustrated. Pocket size 6¼x4½ ins. Sent by mail for 25c.
MONTGOMERY & CO.,
105 Fulton St., New York City.

GAS ENGINE IGNITERS

Price, $15.00



LATEST TYPE. BEST MADE.
For Marine, Automobile or Stationary Engines. Fully Guaranteed. Write for Circular.
The Carlisle & Finch Co.,
233 E. Clifton Ave., Cincinnati, Ohio

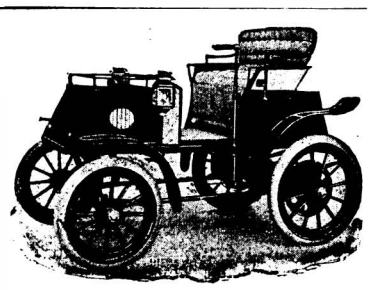
Columbia Automobiles

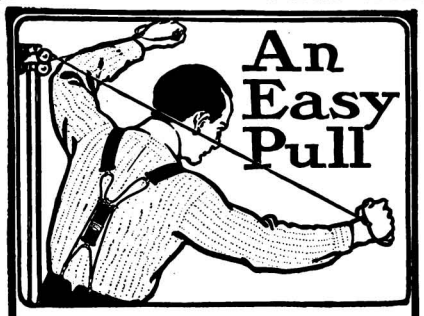
Electric and Gasoline

RUNABOUTS, SURREYS, TONNEAUS
DELIVERY WAGONS, VICTORIAS, CABRIOLETS,
BROUGHAMS, TRUCKS, AMBULANCES,
POLICE PATROL WAGONS.

Write for our latest Catalogue illustrating and describing seventeen different Columbia Models.

ELECTRIC VEHICLE CO., Hartford, Conn.
New York, 100 Broadway. Boston, 43 Columbus Ave. Chicago, 1421 Michigan Ave.





An Easy Pull

PRESIDENT Suspenders

are the most comfortable suspenders because the principle at their back adjusts itself to every bend of the body. Every pair guaranteed. Look for "President" on the buckles. Trimmings cannot rust. Made in all styles—heavy or light—also for youths. Price 50c everywhere, or mailed postpaid. Say light or dark—wide or narrow.

Holiday goods in individual gift boxes now ready. President playing cards—instructive, entertaining, unique, 25c.

C. A. EDGARTON MFG. CO.,
Box 222 E Shirley, Mass.

GARDNER GRINDER FOR FLAT SURFACES ACCURATE & RAPID FOR UP-TO-DATE SHOPS
C. H. BESLY & CO. CHICAGO, ILL. U.S.A.

CRACKS IN FLOORS...

are permanently and easily filled with Grippin's Wood, Crack and Crevice Filler and patent applier. Before finishing your floors, whether old or new, write for our booklet on Grippin's famous floor specialties, to
GRIPPIN MFG. CO., Dept. C., Newark, N. Y.

MR. BOOKKEEPER,

do you know what the Comptometer is? It costs you nothing to find out. It will help you out on that trial balance. It insures accuracy, is twice as rapid as the best accountant and relieves all nervous and mental strain.
Write for Pamphlet.
FELT & TARRANT MFG CO.
52-56 ILLINOIS ST., CHICAGO.

50 YEARS' EXPERIENCE

PATENTS

TRADE MARKS
DESIGNS
COPYRIGHTS &C.

Anyone sending a sketch and description may quickly ascertain our opinion free whether an invention is probably patentable. Communications strictly confidential. Handbook on Patents sent free. Oldest agency for securing patents.

Patents taken through Munn & Co. receive *special notice*, without charge, in the

Scientific American.

A handsomely illustrated weekly. Largest circulation of any scientific journal. Terms, $3 a year; four months, $1. Sold by all newsdealers.

MUNN & Co. 361 Broadway, New York
Branch Office 625 F St., Washington, D. C.

NEW ENGLAND WATCHES

have a world-wide reputation gained by results as accurate timekeepers. We make all sizes and styles. We sell only complete watches. Catalogs sent on request.

THE NEW ENGLAND WATCH CO.

37 & 39 Maiden Lane, New York
131 Wabash Ave., Chicago.
Claus Spreckels Building, San Francisco.

© 1902 SCIENTIFIC AMERICAN, INC.